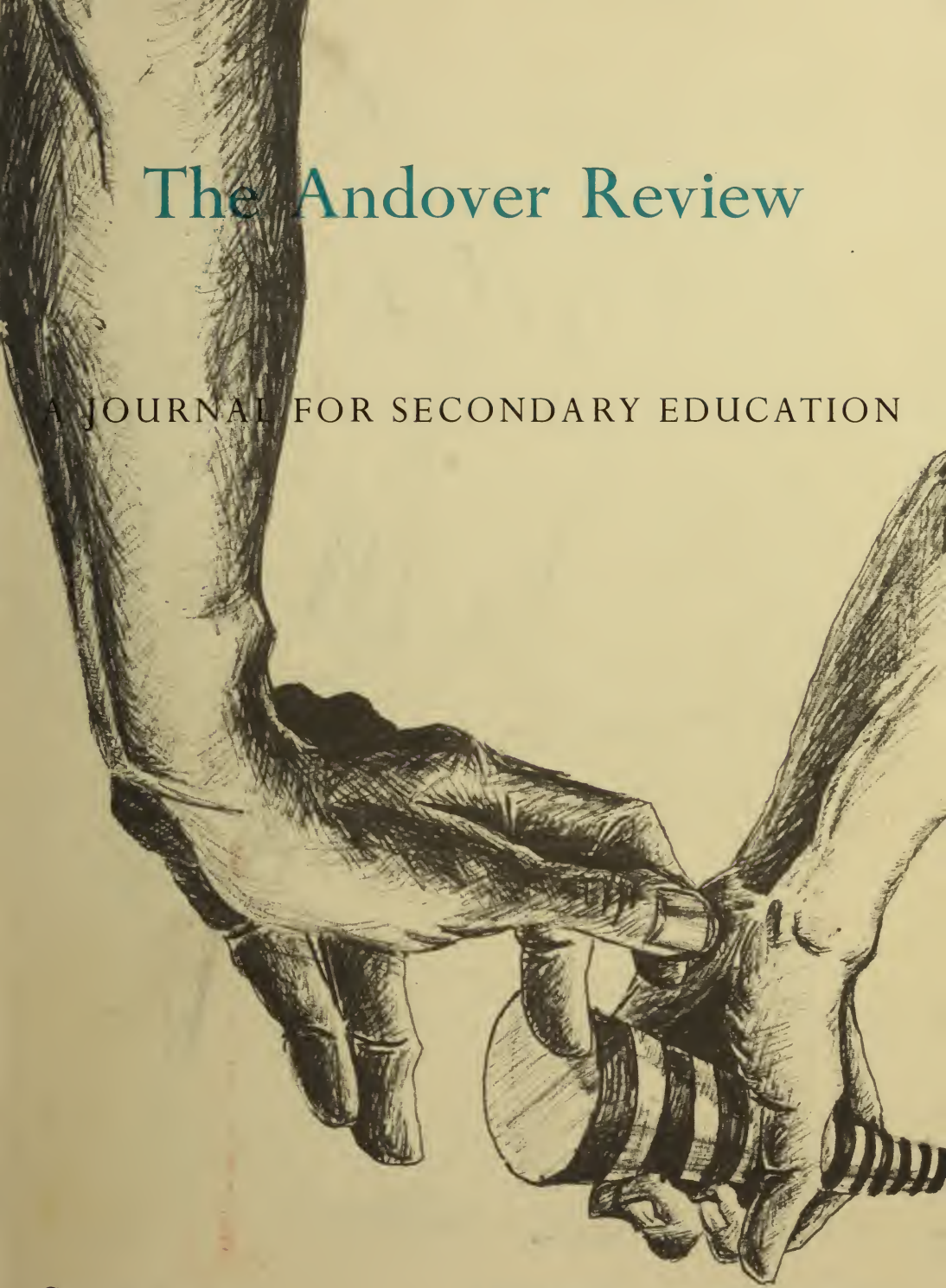
The Andover Review

A JOURNAL FOR SECONDARY EDUCATION



Spring 1978

Learning in Adolecsence

THIS IS THE FIRST of two issues devoted to Learning and Adolescence, the subject of a symposium held at Phillips Academy as part of the academy's observation of its bicentennial. The purpose of the symposium was to bring together teachers and scientists – psychologists, psychiatrists, behavioral scientists – in an attempt to combine theory, clinical investigation and practice to find what we could in three days about how adolescents learn. We made a brave beginning, although this participant learned as much about how adults, teachers and scientists viewed adolescents as he learned about adolescents themselves. I refer the reader to Peter Farrow's questions and drawing (p. 14).

Before the conference, participants submitted papers illustrating their current work and concerns. These papers were collected in a huge notebook which served as the working base of the conference. The articles in this issue are a selection of the papers submitted. It should be pointed out that with the exception of Farrow and Brown, the articles were written neither for the symposium nor for *The Review*. They will serve, however, to give the reader an idea of where we started. The fall issue will reveal not where we ended but at least the sparks struck by some able and concerned minds and perhaps some conflagration.

Dr. Eisenberg's article, which bears the subtitle "A Crisis of Adolescence," proved to be a keen insight into what came to be one of the principal concerns of the conference. Adolescents are in crisis; however, they are not alone. We can see the tensions under which they operate and learn because, for right or wrong, they are an identifiable culture. Not as clearly identifiable is the crisis under which society as a whole lives. One group at the conference concentrated on tensions in the classroom which come about through the interactions between teachers and students. This and other studies will be represented in the next issue.

The Editor

THE REVIEW invites articles, poetry and graphics from all quarters and will select material with concern for secondary education. If mailed, graphic work should be insured by the sender. It will be returned in due course in the same manner.

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The Andover Review

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ARTICLES

POETRY

GRAPHICS

Questions of Value

A Crisis of Adolescence

LEON EISENBERG, M.D.

For almost all of some 50,000 years of *Homo sapiens*, save the last few hundred years, the family served as the principal conservator as well as transmitter of culture.[1] In traditional societies, the young had only to be prepared to emulate their parents' behavior in order to function successfully as adults. Occupational skills were passed on vertically, largely by apprenticeship. Social skills were acquired by imitating the varieties of adult behavior visible to the child and by attending to social sanctions. The family was most often the work unit; parents and children labored as well as lived side by side. Parental norms represented the folk wisdom accumulated over millennia of experience; respect for age was functional as well as demanded; those who had lived longer knew more because they had encountered and overcome more of the expectable vicissitudes of the environment. Note well, however, that this celebration of the virtues of the traditional family refers only to its adaptive function in a static world; in that world, life for the vast majority was marginal and tenuous. Catastrophe, starvation,

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This article originally appeared under the title "Youth in a Changing Society" as a chapter in *The Family – Can it be Saved?*, Victor C. Vaughan, III and T. Berry Brazelton, Editors;

[1] Eisenberg, L.: The challenge of change, Child Welfare 39:11, 1960.

illness and death were man's constant companions for the greatest part of history.

With the transition from agrarian to an industrial civilization, the family's role as the economic unit was gradually eroded. Work roles of men and women became more sharply differentiated. The demand for specialized skills led to the introduction of universal schooling as the institutional invention to prepare the young for adult roles, with an inexorable and progressive diminution in the centrality of the family. At the same time, the industrial world required a mobile labor force; in the process of multiple moves, the extended family was lost as a buttress against misfortune and a resource in a time of troubles. Traditional solutions became less effective for the challenges provided by social change; adaptability, the hallmark of youth, had greater immediate salience than the overlearned and more rigid responses of the old. Again, if the price of change was the gradual erosion of traditional values, it also brought with it such benefits as better health, longevity, opportunity and a standard of living that few have hesitated to pay the price. Indeed, the developing nations today, rather than drawing back in dismay at the contradictions glaringly visible in the midst of Western "success," seem hell-bent on following our example.

The concepts of ecology have become even more widely employed in contemporary political debate as we become aware of the ways in which we have upset the delicate balance of things on this planet.[2] We consume irreplaceable resources; we create more waste than we can dispose of; we multiply without thought of consequence. We have developed technologies of convenience only to discover that we have transmuted gold into dross. We have become a species endangered by the psychosocial fallout from chain reactions within our modes of living that occur at an unprecedented rate.

What we have failed to recognize is that the rate of change is accelerating; the conventional indices of "progress" are insufficient

[2] Eisenberg, L.: Poverty, professionalism and politics, Am. J. Orthopsychiatry 42:748, 1972.

to measure full costs; unevenness in the distribution of benefits belies the appearance of average gains; doubling and redoubling of quantity threatens qualitative deterioration. Changes in our daily lives occur at such a pace that discontinuities rather than mere differences appear between the life experiences of the old and the young. Social pollution undermines the role and function of the family.

The nuclear family has become almost the sole source of affective sustenance. Mobility has attenuated ties to the extended family and to friends. More and more of us live in large metropolitan aggregations, work for ever larger and therefore more bureaucratic organizations and are more remote from and less able to influence governmental agencies. Interpersonal transactions are dominated by ritual and rule that leave little room for affective interchange. With all our emotional eggs in the nuclear family basket, breakage is both more inevitable and more devastating when it does occur. Economic stringency requires both parents to work (when work is available) and thus to be less available to each other and to their children; society has not yet provided social supports in the form of family extenders that could mitigate the impact of work demands.[3] That the family is ill-equipped to withstand these strains is documented by the divorce rate and the growing number of single-parent families, a disproportionate number of which are found below the poverty line, doubly disabled.

That our young are in serious trouble is evident from the merest scanning of such crude social indicators as soaring rates of juvenile delinquency (including a disproportionate increase in crimes against persons), the large numbers who fail to learn to read with proficiency by the time they leave secondary school, and even the decline in Scholastic Achievement Test scores among college applicants, the most privileged of our youth. The over-all figures, appalling as they are, convey only part of the wastage. The situation among minority groups is severalfold worse; it is they who bear the brunt of the social breakdown.

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[3] Eisenberg, L.: Caring for children and working: Dilemmas of contemporary womanhood, Pediatrics 56:24, 1975.

How have we come to be where we are?

As with the family, the circumstances of the young have undergone radical change. To begin with, there has been a cumulative trend toward lowering of the age of puberty such that over the past century in industrial nations the age at onset of menarche has declined by four months in each decade because of better nutrition and health. This secular trend has finally reached an asymptote among middle class populations. The lasting result, however, is a significantly younger age of entry into the physiologic state of adolescence.[4] Simultaneously with this biologic transformation, the duration of adolescence as a social stage has been sharply increased at the upper end by the prolongation of the time of schooling as preparation for adult work roles. Whereas at the turn of the century less than 15% of young Americans between 14 and 17 were enrolled in secondary schools, the ratio now stands on its head with well over 90% in school. Colleges and universities, enlisting an elite 4% of the 18 – 21-year-olds 75 years ago, now incorporate ten times that percentage. There have been comparable gains in the proportion attending graduate schools for four more years; they comprise about half of those who complete college (that is, 30% of those who enter it). Conversely, there has been a progressive decline, even during the past decade, of adolescents and youth participating in the labor force, even part time.[5]

It is difficult for those of us who grew up considering schooling a privilege (and still regarding it as such) to recognize that schools control a vast legion of draftees, not volunteers. The growth in the population, the lengthening of the school term, the reduction in the frequency of absences and the increasing rates of retention in higher grades combine to produce an aggregate of youth-years in full-time school such as to make schooling a huge growth industry, only now showing the first signs of recession because of a declining birth rate. Emphasis on economies of scale rather than on the quality of the learning environment led to consolidation of

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[4] Eisenberg, L.: A developmental approach to adolescence, Children 12:131, 1965.

[5] Coleman, J. S.: *Youth: Transition to Adulthood* (Chicago: The University of Chicago Press, 1974).

schools and school districts. In the 1960s alone, college enrollments doubled; the unprecedented increase in the student population was accommodated by growth rather than multiplication of universities, such that 50 now enroll in excess of 20,000 students (some as many as 50,000!) and 60 enroll more than 10,000. Sheer numbers ineluctably dictate organizational complexity, proliferation of administrative bureaucracy and assignment of priority to managerial goals. However unreal President Eliot's image of the student at one end of a log facing Professor Hopkins at the other, the late twentieth-century counterpart is that of a lecture hall full of students relating to the Professor's image by remote telecast. The potential for diminishing segregation by race and class, which might have offset these diseconomies of size, has notably failed to occur because of housing patterns, the gerrymandering of school districts and selective admission policies.

The environment of the school contrasts sharply with that of the work place. It focuses on learning rather than doing; it provides opportunities for self-development at the expense of contributing to others. Its thrust is competitive rather than cooperative; its graduates filter through an ever-narrowing sieve, safe passage through which is correlated with test and grade performance. Nowhere is the devastating impact of this desperate scramble more evident than in its destructive effect on the college experience of premedical students, only one in three of whom will gain the coveted laurel of admission. For all of these years, the student remains financially a dependent. In contrast, the young worker is a producer, who not only supports himself or herself but society as well. The nature of the industrial enterprise demands collaborative effort on the production line. Moreover, the worker's limited ability to increase wages can be enhanced only by joining with others in a trade union. The work may be – all too often is – intrinsically unsatisfying, but the only avenue for modifying it lies in common undertakings with fellow workers, both older and younger.

One major effect of the progressive substitution of schooling for working and the gradual constriction of family size and time to-

gether has been the age-segregation of youth from adults and children. Commercial enterprises have long since targeted a significant fraction of their promotional efforts on this huge market. In the decade of the 1960s, the population aged 14 – 24 years increased in absolute count by more than it had in all of the 60 preceding years of this century; its ratio to the adult cohort (25 – 64 years of age) grew from 0.32 to 0.45, a 40% change! Coleman[5] has stressed the features that characterize "the youth culture." It looks inward toward its peers who become models for attire, entertainment, politics and "life style." It substitutes age-mates for family members as sources of approval and affection; the isolation and alienation it feels as a group feed its press for autonomy, which often is defined more in the negative than in the positive mode; and its self-perception as underdog generates a receptivity to change, with insufficient attention to social costs. The exuberant and unrealistic slogans of the French "youth revolt" in May of 1968 so threatened the concern for social stability in the rest of the population that the conservative Gaullists received a substantial mandate in the subsequent election.

You will have noticed in this a shift toward a delineation of youth almost as though it were a social class, without differentiation into worker or student, poor or rich, black or white, female or male. Yet, for each of these subcategories, lifetime expectations differ sharply, particularly when disadvantage by income, race and sex is summed. The young in each of these categories share more fully the attributes of their own elders than they do those of youth as a group. We are in danger of perpetuating the very error embodied in the youth slogan popular just a few years ago: "Never trust anyone over 30."

The problems of youth do indeed have special poignancies, but they are the problems of society in general and cannot be solved except in that context. When the PSAC Panel on Youth[5] calls, and rightly so, for job opportunities for the young and interleaved work-study programs, with a lower minimum wage to facilitate youth employment, its recommendations are hollow while there are 9,000,000 Americans out of work, with an official over-

all unemployment rate of 8.7% but a rate for black teen-agers of 41.6% (*New York Times* 4/6/75). The gradual extension of the school-leaving age and the laws against child labor may have had humanitarian aims; they have also served to restrict the potential labor pool when it threatened to expand beyond national capacity to absorb it. The bitter antagonism among white blue collar workers against affirmative action in behalf of excluded minorities assuredly reflects racism and sexism, but it is markedly intensified by the shrinking labor market. We observe precisely the same phenomenon in academe, where the resistance to equity for women and minorities has taken on a new urgency (and more elaborate rationalizations) now that fewer faculty positions are to be had. Unless youth, women and minorities make common cause with white male workers in fighting for full employment, all must suffer.[3]

To state it flatly, the problems of youth in a changing society are the problems of a society in the midst of a crisis of nerve. For the better part of this century, the power of the United States was so awesome that it was – or appeared to be – decisive in events the world over. The fall of the Kuomintang on mainland China was the first major evidence of the era we were entering. It was so out of keeping with America's self-perception that the prevailing theory was that of conspiracy; it wasn't that the outcome was beyond our control; we were betrayed by cryptocommunists in high government positions. The collapse of the regimes in Cambodia and Vietnam is a further blow to belief in American hegemony; it remains to be seen whether this, too, will be explained away or recognized as hard data that must be accommodated within a realistic world view. In the same span of time, the malign neglect of civil rights and the gradual abandonment of even the slogan of a war against poverty force acknowledgment of the necessity for structural change in the distribution of benefits; overflow bounty from an expanding gross national product simply doesn't trickle down equitably.[2] The code word "Watergate" stands for an unwanted view of the extent to which cherished democratic rights have been violated behind a façade of legal government. Inflation

and recession bring the mess into every home. We adults have responded by doubting our nation instead of its leaders, by doubting ourselves instead of our misconceptions, by turning against our young because they have insisted on confronting us with our contradictions.[6] Despair substitutes for thought and paralyzes action. The sophisticated professorial stance, 1975 model, is to decry the soft-minded "knee-jerk liberalism" of the preceding decade, to refer learnedly to theologic doctrines of the imperfectibility of man and to settle down to an observer's role – on a tenured salary.

Cynicism and pessimism guarantee perpetuation of the status quo. The failure lies not in the grandness of our dream but in our lack of commitment to it. The shattering of illusions opens the way to coping with reality. Let me set forth some of the elements of a social program that can begin to restore ecological balance in the quality of life.

The essential role of the family and the satisfactions it provides to its members need buttressing. This should include income maintenance, universal health care and a network of child care centers to ensure the healthy development of children. If move we must, we can reinvent the extended family by including friends as kith and kin. Foster grandparents provide gratification for themselves as well as the youngsters they relate to. Our goal must be a culture in which the welfare of children is the concern of every citizen.[3]

A second set of measures would focus on facilitating intergenerational sharing. Day care centers and nurseries can be located adjacent to intermediate and secondary schools. Adolescents not only will provide a source of person power but will learn how to be better parents in the process of contributing to the development of the young. Adolescents can learn to teach as well as be taught by serving as tutors for younger children. In setting classroom goals, emphasis should be placed on group achievement in addition to individual accomplishment; each should feel some responsibility for the success of the other. Work experiences for high school and college students should be facilitated by making time available

[6] Eisenberg, L.: Student unrest: Sources and consequences, Science 167: 1688, 1970.

within the regular program and encouraging experimentation with time out at no cost to subsequent re-enrollment. Social subsidy of both early work and later education should be universal in order that opportunity not be limited by income.

At their best, the adolescent years are characterized by the development of idealism and concern for the general welfare. No educational task is more critical than the cultivation of these most human of all qualities by providing experiences to permit their fullest flowering. However short such programs as the Peace Corps and Vista have fallen from their announced goals, they can serve as prototypes of opportunities for the young to attain full humanity by contributing to others. This is but a special instance of a more general proposition: the need for meaningful work roles throughout the life span. It is obscene that we tolerate unemployment (as a means of slowing inflation by shifting its burden to an underclass) in the midst of work that needs doing for social benefit (housing, urban redesign, recreational facilities, human services). It will be a major challenge to re-examine the nature of work, the ways in which its organization can be modified to enhance the satisfactions it brings and in which a broader range of personal choices can be ensured. Work will remain work, but its significance will differ if it is seen to be contributory, if it is socially valued and if each of us has a felt need to participate in the social enterprise.

In each area, we confront similarities between the problems bedeviling the young and the old and the impossibility of resolving the one without simultaneously attending to the other. The flamboyance of youth enables it to articulate, sometimes in caricature, values implicit in a culture that is excessively individualistic in its orientation. "Doing your own thing," even with the proviso that your own thing not injure others, is grossly insufficient as a precept for the social contract. It gained currency in an era of manifest affluence in which a few could enjoy the luxury of personal indulgence so long as the majority, whether by necessity or by choice, continued to provide essential goods and services. It betokens a serious failure in the process of socialization if our citi-

zens come to maturity without a sense of obligation to others. The lack of a shared moral commitment underlies intergenerational alienation.

Social groups as different in their political structure as the Israeli kibbutz movement[7] and the collectives in the People's Republic of China[8] have succeeded in evoking responsible performance in their youth and, at least to some extent, in internalizing a sense both of social obligation and of personal worth as a consequence of that performance. From our perspective, that spirit of collectivity appears to be exacted at too heavy a price in its loss of individual choice. Let us acknowledge that we have overstressed individuality at a considerable cost to social connectedness. These values should not be antinomies. The social contract exists to foster personal freedom; self-fulfillment enables the individual to contribute most effectively to society. When personal choice is enjoyed by some only at the cost of intolerable restriction to the freedom of others, there will be a day of reckoning and an inescapable press for change.

I have written as a moral philosopher. I hope I have persuaded you that questions of value permeate the issues we are addressing. I have set forth my belief that concern for social justice and equity is the organizing theme for fostering adolescent and young adult development. From that central concept flow parallel proposals for political and educational reform. What youngsters are taught in school and in the home as the good life must bear a recognizable relationship to the world in which they live, as the goal toward which it is striving.[9] The teacher must be a doer as well as a learner. The young question what we have come to accept; if we hear their questions and join them in the search for answers, both will become the wiser.

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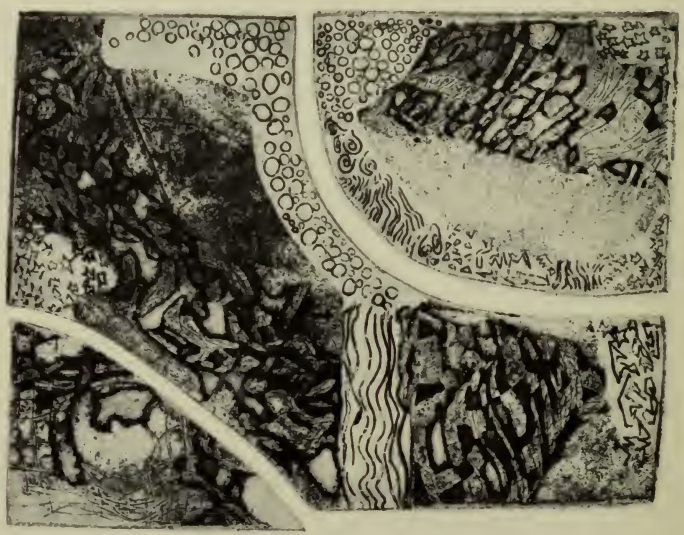
[7] Eisenberg, L., and Neubauer, P.: Mental health issues in Israeli collectives, J. Am. Acad. Child Psychiatry 4:426, 1965.

[8] Chan, I.: New people in new China: As reflected through education and child rearing. Presented at the Biennial Meeting of the Society for Research in Child Development, Denver, April 11, 1975.

[9] Eisenberg L.: Racism, family and society: A crisis in values, Ment. Hyg. 52:512, 1968.

Let me conclude with words I used in another context:[10] "Our most central task is encouraging the development of humane values based on the recognition that we are a single species. . . . Learning must become a social enterprise informed by concern for others. . . . By acting on behalf of our species we become men and women. . . . The study of man takes its meaning from involvement in the struggle for human betterment. Struggle it is and will be; privilege does not surrender easily; false belief is not readily dispelled. The optimism about man's potential I urge upon you is not the comfort of reading history as a saga of human betterment which will one day be complete. It matters, and matters dearly . . . whether that day comes sooner or later; whether it comes at all is not determined by history but by the men and women who make history. . . ."

[10] Eisenberg, L.: The *human* nature of human nature, Science 176: 123, 1972.



KRISTEN TIMKEN

SHARKS

Sharks in these waters! the trim white
Coast Guard cutter repeats and repeats

Its friendly persuasive warning
To each beach, and the swimmers come

Hurriedly to shore, to lie hot and lazy
On the sharp sand, looking

All afternoon seaward for the steep
Dark dorsal fin

That might or might not come pricking
Like a needle through the small wind-waves.

If it does
They will rise and point excitedly and rush

To the water's edge, and then back.
And if it does not, still they will dream

Of the sinuous explorers of the blue chambers
Of coastal waters moving

Easy as oil, without a wasted stroke,
In and out the warm coves. But slowly

The heat eases, and the wind picks up,
And since nothing has happened

A few figures dare the water to their waists,
Forgetting, as men have always forgotten,

That life's winners are not the rapacious but the patient;
What triumphs and takes new territory

Has learned to lie for centuries in the shadows
Like the shadows of the rocks.

MARY OLIVER

the Presymposial state

PETER FARROW

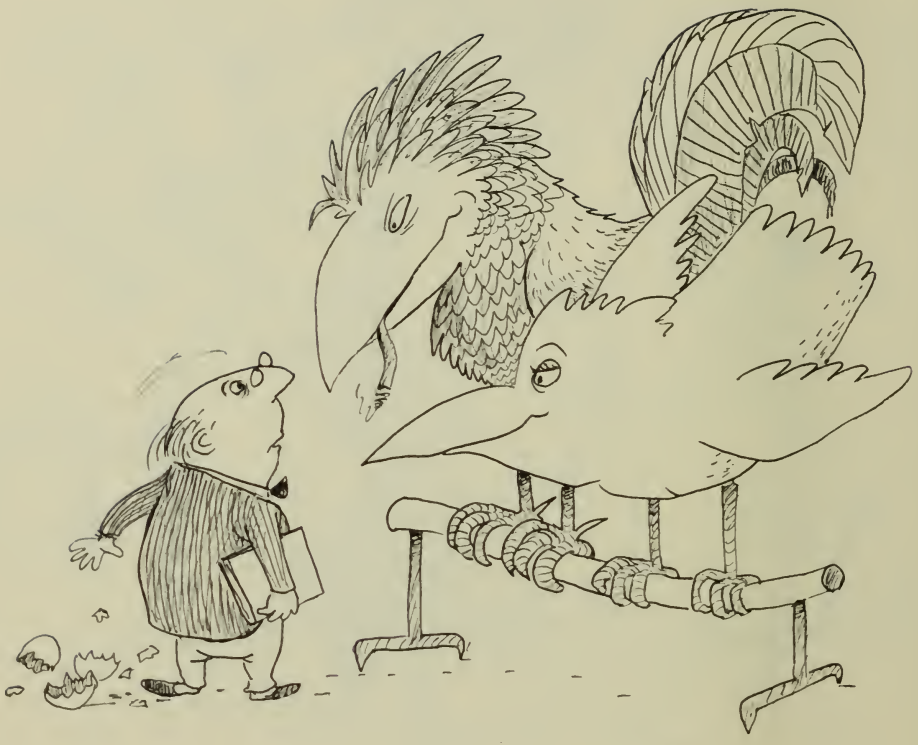
While I don't know what will happen at Andover
if I do *submit this paper. . . .*

. . . *I* do *know what will happen at Country Mile*
If I don't. . . .

Therefore:

Education seldom suffers from a shortage of theories. But it does suffer a severe shortage of questions about itself, most of all about its own subjective state.

Some of the questions following are trivial, some downright nasty, all but a few unblushingly subjective. And all are from the teacher's side of the table, not the scientist's. But since whatever truths or propositions the symposium may develop will have to be translated into the classroom, the teacher's subjective state may well prove to be the crucial variable.



How many of the problems (and phenomena)
of 14-18 are generated by ourselves?
Are our own chickens coming home to roost?

Since all education involves some vision of the future, how much of that vision is self-projection?

How clearly do we accept that our models may not be best — even for ourselves?

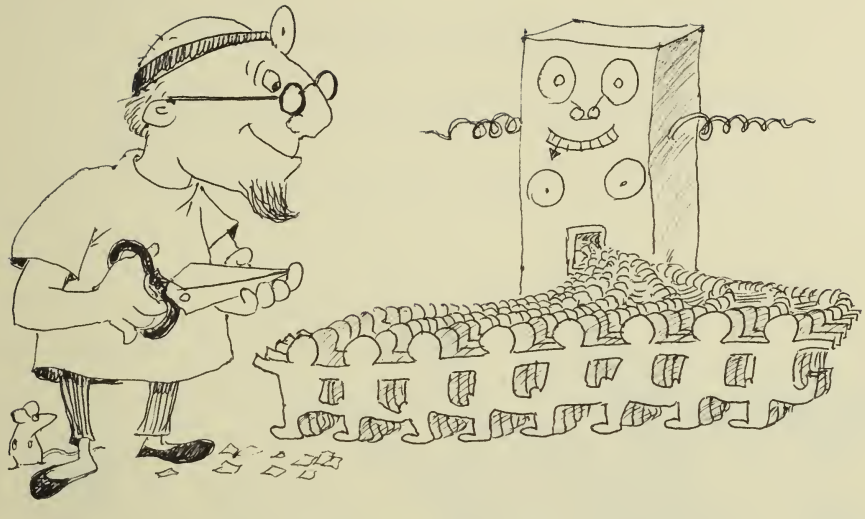
We are surely aware of the "generation gap." Are we equally aware of its absolute necessity *— that, in the long run, it is neither a social nor psychological phenomenon, but a* phylogenic *one? (We meet as a symposium of human beings rather than as a clotting of protozoa only by virtue of endless generation gaps, after all.)*

How clearly do we separate teaching *from* learning? *Do we accept that they are essentially two entirely separate processes which may, on occasion, happily coincide?*

. . . *And how clearly do we separate* education *from* training?

Do we accept that education is a subjective, non-reproducible and ultimately non-measurable affair? That it is inherently not *adaptable to mass schooling — at least under present conditions?*

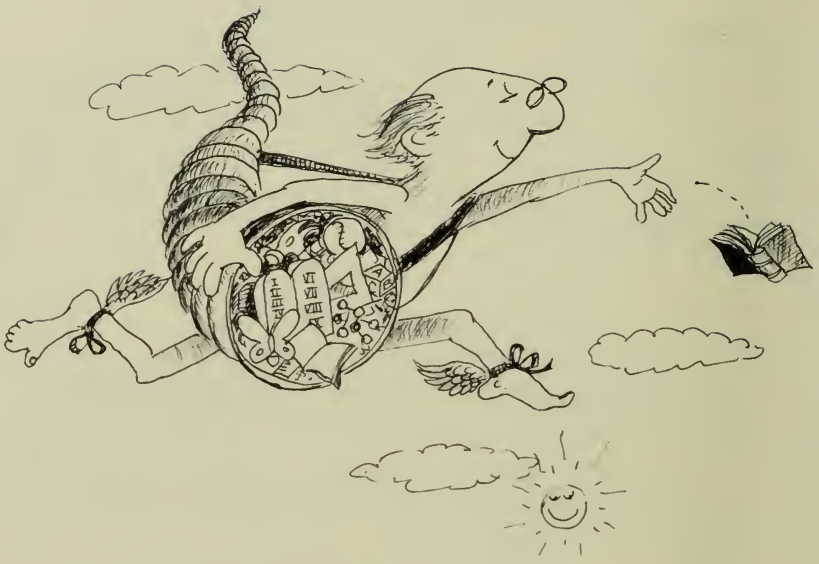
Do we accept (and thus begin to fight) the fact that most of today's education is essentially social and economic conditioning, properly belonging in the field of training and not education at all?



. . . Are we seeking to utilize science — or hoping to scientize *education as a whole? Is our increasing dependence on objective (and largely quantitative) method contributive to learning* per se?

Are we dealing with something which is, at heart, not a science at all, but an art?

If an art, reproducible result is anathema; if a science, reproducibility is essential. Is current "scientization" a search for a reproducible result — or mass-producible method?



If we are to be scientific, then how well can we accept the fact that education is essentially an information distribution system, *scientifically inseparable from cybernetics, subject to physical law, and exhibiting many of the principles of both classical and modern economics?*

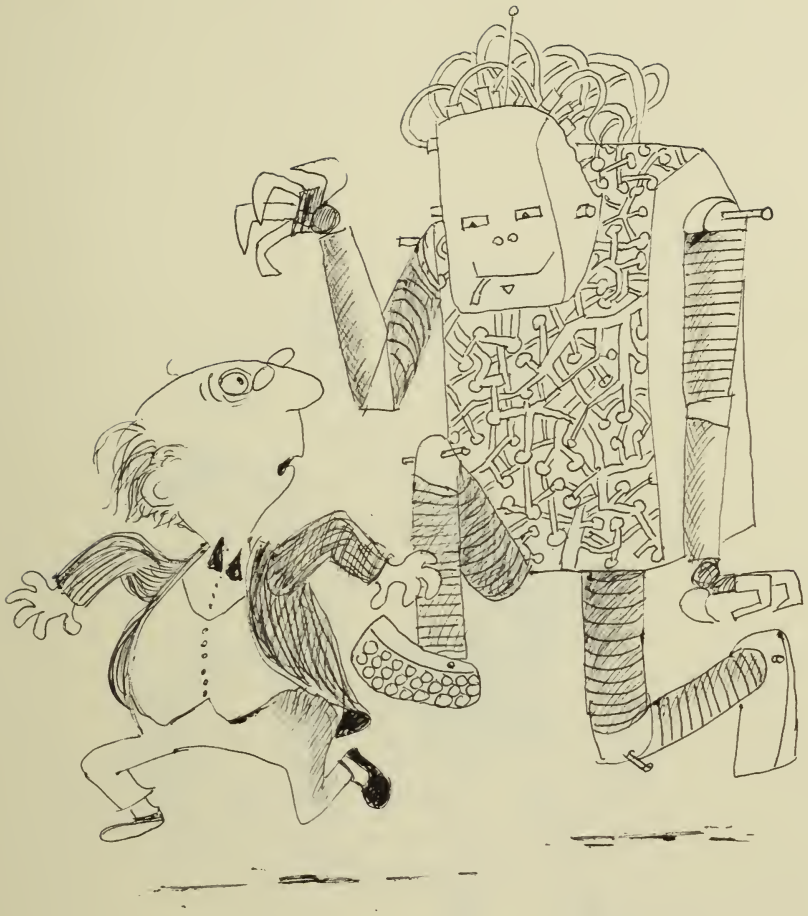
How well have we assayed our role in such a concept?

. . . And what have the results been?

What criteria do we employ to determine who gets what?

And what criteria do we apply to those *criteria?*

. . . And to what extent are those same criteria modified by our tacit expectations?



At what point are we prepared to say "No" to science's influence in education?

Is education relying too much on mere professionalism?

Exploiting the "professional mystique?"

. . . Or, if not the "professional mystique,"
how about the "Mendicant Myth"?

Have we at last admitted, to ourselves at least, that
today education is . . .

. . . one helluva big business —second only to national "defense" in its dollarhood and, like any other business, incorporating such factors as planned obsolescence, consumerism, unitization, deferral, consent engineering, premanaged production, trade unionism, economic life and organized waste?

. . . And, of course, profit.

And through all this, have we asked, really, what – and who – pulls our strings? What are the origins *of our criteria? How effectively do we balance (or defy) external demand?*

Doubtless, we have the freedom to inquire, the freedom to discover. Do we have, however, the freedom to apply? Has academic freedom been compromised not by tyranny, but by the orchestration of reward and by benign neglect?

As for our own innermost thoughts —
as people c. 35-65 undertaking a study of
other persons 14-18:

We can probably agree that 14-18 isn't quite what it used to be....

. . . We may even admit to having been 14-18 ourselves.

. . . But how willingly do we accept
that we will
never
never
never
be 14-18 again?

In all, are we running a little scared?

. . . Perhaps so. . . . .

But the chances are still pretty good that the kids will forgive us.

COCK ROBIN

Who made the poem?
Father claimed "I
with my will
I cast the die."
"Me" sang Mother
"with my mothering song."
"Wrong," piped teacher.
"I worked long
sifting right and sorting wrong."
"We" said the friends
"did the chorus part."
"No," said the stoneman
"It was I, bruised the heart
and cleared the eye."

Diana der Hovanessian

FALLING INTO THE MOMENT

Everyone is disappearing,
you must be getting older, you are

stripping, one by one, your leaves.
You begin to give away books,

bracelets, your comb collects hair,
freckles pepper your hands.

Your body repels you, the mirror
no longer casting a spell.

Yet, even now, when you let yourself
fall into one of the moments

you are trying to rush through,
you find yourself in a small boat

paddling channels, gathering lilies,
the sun settling on the water.

An experiment in light, a kind
of chemistry, a simple radiant equation.

Phyllis Janowitz

Before and After

Two Ruminations of a Teacher of Adolescents

WILLIAM H. BROWN

Diversity is the one constant. As one meets a class of fourteen-year-old students, he is struck by differences in height, weight, timbre of voices, experience reflected in discussion, in a word in maturity. If one conceives of this class as on the starting blocks in the race to graduation at eighteen, he cannot avoid the impression that it is a very uneven, indeed unfair start. It cannot be doubted that these differences in physical and social maturity are reflected in differences in the development of skills and capacities of the mind. And yet, when one meets these same students two or three years later, these differences seem to have largely disappeared. The closer students come to graduation the closer they come to a common denominator. What have we done to bring this about? Have we destroyed individuality, and the initiative and the verve that goes with it? Or is there some biological and psychological leveling process which is for the most part independent of the educational process? What seems to be true is that it is exciting to teach this fourteen-year-old class for the very reason of its diversity, and often disheartening to teach the older classes in which the responses are predictable and stereotyped.

In an English 10 class, I taught the *Odyssey* in the Fitzgerald translation, subtle and beautiful poetry. I let the poem teach itself. Nothing was said of the technique of the poetry, of its structure, of its historical significance. There was great excitement, animation in the discussion of father, mother, son, home as well as of adventure, courtesy, customs of hospitality, fidelity, greed and treachery. The following term, we read Twain's *Life on the Mis-*

sissippi. I fell into the trap common to the teacher of English: I found myself talking about technique. Although I avoided set terms of irony, point of view, I emphasized the point that Twain was talking about himself as a young and foolish person in a young and foolish society from the vantage point of an older man. We looked at the tone of sentences and the structure of the paragraphs. There were members of the class who had reached a point in their development in which they could meaningfully talk about irony, tone and structure. There were others who could not but were willing to play the game. And there were still others who were lost and fell silent. The discussion lost its verve; it was dead.

Other differences in the fourteen-year-old class: there were males and females in equal numbers. The most interesting difference that I noted was that the males were far more mechanistic in their approach. They were concerned to make sentences parse; they were amenable to punctuation; they were interested in structure: how a story was put together – how a paragraph was organized. Females were more intuitive: they tended to be attracted to the sound and rhythm of a sentence, rather than its grammatical correctness, to the emotional content of a story, rather than its structure. If these differences are allowed to remain, the net effect is one of mutual stimulation. If I made an attempt to bring them together, to arrive at a common ground, deadness crept in. Diversity is stimulation.

There were blacks, caucasians, orientals, those from well endowed schools and from deprived and depressed schools. These differences too can bring life to the class if allowed to work, and a deadness if suppressed or homogenized. But homogenized they seem to be as the students grow and move to higher classes.

There is, however, a point at which this diversity does not operate in the productive manner which I have indicated. Several years ago we began a concerted effort to admit disadvantaged students, disadvantaged in every sense: ethnic, socio-economic. I taught a segregated class of such students, all but one of whom were black, all of whom came from distinctly deprived

homes, communities and schools: ghetto, country, north and south. If these students had been thrown into the general mix, we feared that they would have been unable to relate to their varied classmates, they would have been unable to contribute, even to communicate. The course was called Language. We studied Swahili, Tagalog. We worked on a generative grammar in these languages and in English. We read and we wrote, and we developed an esprit such as I have seen in few classes. Curiously, as the year wore on, the class developed a healthy diversity of its own, a recognition that the students despite their ethnic and socio-economic similarity had widely different capacities and were at different stages of development. At the end of the year, they went their individual ways and were remarkably successful in their secondary education.

A TEACHER'S INTRODUCTION TO PIAGET

The figure of Jean Piaget hovers over the symposium which serves as the base for this issue of the *Review*. His writings over the past fifty years have brought about a quiet revolution, the results of which in psychology and education are becoming increasingly apparent. It is impossible to summarize the extent of his findings within the compass of a short article. I have, therefore, turned to his *Six Psychological Studies* (Random House, New York, 1967), edited by David Elkind and translated by Anita Tenzer, herself a practising psychologist. These studies, consisting of articles and lectures, cover a period of twenty-five years from 1940 to 1965 and thus give a sense of the range, complexity and development of Piaget's theory. Elkind's introduction is of invaluable aid to both the layman and the specialist. He gives clearly the bases of Piaget's theses, previously available only to the psychologist.

The first point that Elkind makes is that Piaget is a genetic epistemologist, not a psychologist. In other words, he is concerned with the theory or science of the method and grounds of knowledge as the basis of tacit knowledge evolving from birth through early childhood to adolescence and adulthood. The three themes which persist in Piaget's evolving work are logic, relativity and dialectics. Elkind makes the sobering observation that genetic epistemology is a multi-disciplinary system demanding as a minimum an acquaintance with biology, physics, logic and philosophy. Whatever use the psychologist or the educator makes of Piaget, and the possibilities are virtually unlimited, it should be clear that the result is just that – the psychologist's or the educator's use, not Piaget himself. I am certainly not a psychologist and resent the term educator. I am, however, a teacher and as such, despite the great demands Piaget makes, find his writing exciting and provocative.

The demands are great indeed and not lessened by the necessity of reading in translation. Piaget's French is difficult as French; therefore, Tenzer's translation is all the more vital. For instance, the term *egocentricity* has for the speaker of English an unavoidable pejorative implication. As used by Piaget it is a statement of fact as to the way the child up to the age two perceives the world around him. *Equilibrium*, the key to Piaget's dialectics, does not imply stasis but is something which is active and ongoing, the basis of the genesis of genetic epistemology. *Structure*, another key word, is "a mental system whose principles of activity are different from those of the parts which make it up."

The stages which Piaget indicates in the development of cognition of the child are the best known and most often referred to. They are birth to the age of two, from two to seven, from seven to twelve and adolescence. Piaget recognizes that there are individual variations within these groupings caused by the differences in heredity and environment, but at the center of his findings are the stages of cognition themselves.

Birth to age two is characterized as a Copernican revolution. At

the beginning the child grasps everything to his own body; at the end, when language and thought begin, the child is but one entity in a universe that he has constructed himself. The child starts with only one system of knowing labeled sensorimotor. This system is differentiated into new systems which together with the old constitute a broader organized totality. (I am here incorporating the diction of Piaget as translated by Tenzer.) The infant by the age of two has constructed categories of object, of space, of causality and of time – all these in terms of practice and action, not in terms of ideas or thinking.

Ideas and thinking are made possible by the acquisition of language, which characterizes the second stage, two to seven. Language allows the child to reconstitute the past and anticipate the future. It also begins the socialization of the child, drawing him from his initial egocentric state. This age is characterized by practical intelligence; action far outweighs thought. The child does things indicating intelligence but often can not explain why. At this stage reality is constructed with the self as model. Moral thinking is in terms of obedience to the adult.

Stage three, from seven to twelve, is marked by the beginning of logic in concrete terms. The child at this stage will accept rules of a game such as marbles as handed down to him rather than play egocentrically as he does in the previous stage. The morality of unilateral obedience changes to one based on mutual respect. The child becomes capable of cooperating. Intuitions become operations when they are systematized through action and become part of a larger whole. Father, son, uncle, aunt become part of the concept of relationship. Numbers are not random – 3, 25, 10, 6 – but part of a system – 1, 2, 3 or 2, 4, 6, 8 or 3, 2, 1, or 8, 6, 4, 2 – in other words reversible, a necessary quality to the nascent logic characteristic of this stage. Addition is reversible to subtraction; multiplication, to division. Time, rate and space are concepts in that they are what Piaget calls *schemata*, within which thought becomes possible. It would seem, then, that the logical process is complete at approximately age twelve and that adoles-

cence is merely an awkward physical passage to adulthood.

However, there is a fourth and for the purposes of secondary education a vital stage, that of age twelve to an undetermined adulthood. What distinguishes stage three from stage four is movement from concrete logical processes to formal or abstract logical processes, or what Piaget calls "hypothetico-deductive" thinking. Piaget recognizes in passing the phenomenon of puberty and the disequilibrium it brings but does not put it in a central position. Rather he sees hypothetic-deductive thinking as the end of a continuing process which begins in early childhood, something that coincides with puberty but is otherwise unrelated. What is more, the concrete operations of stage three must be complete before the formal operations of stage four are possible regardless of age or physical state. There are indeed adults of any age still operating concretely, incapable of formal operations.

At stage four the power to think in terms of concepts freed from concrete manipulations leads the person to impose on the world and the self theoretical possibilities. This theoretical self and world are out of equilibrium with the actual world, the world outside of adolescent thought. A compensating accommodation with reality brings about a new and advanced equilibrium, which presumably leads to adulthood. This same hypothetico-deductive thinking produces a *lebensplan* (life plan), which in turn creates a personality distinct from the egocentric self of the early stages.

All the foregoing comes from the first and the longest of the six studies, which Piaget summarizes as follows:

> This then is mental development. In conclusion, let me point out the basic unity of the process which, from the construction of the practical universe by the infantile sensorimotor intelligence, leads to the reconstruction of the world by the hypothetico-deductive thinking of the adolescent, via the knowledge of the concrete world derived from the system of operations of middle childhood. We have seen how these successive constructions always involve a decentering of the initial egocentric point of view in order to place it in an ever-broader coordination

> of relations and concepts, so that each new terminal grouping further integrates the subject's activity by adapting it to an ever-widening reality. Parallel to this intellectual elaboration, we have seen affectivity gradually disengaging itself from the self in order to submit, thanks to the reciprocity and coordination of values, to the laws of cooperation. Of course, affectivity is always the incentive for the actions that ensue at each new stage of this progressive ascent, since affectivity assigns value to activities and distributes energy to them. But affectivity is nothing without intelligence. Intelligence furnishes affectivity with its means and clarifies its ends. It is erroneous and mythical to attribute the causes of development to great ancestral tendencies as though activities and biological growth were by nature foreign to reason. In reality, the most profound tendency of all human activity is progression toward equilibrium. Reason, which expresses the highest forms of equilibrium, reunites intelligence and affectivity.

As mentioned earlier, the three basic Piaget themes are logic, relativity and dialectics (equilibrium). Piaget makes the point that logic is not innate; it is acquired by the developing systems outlined above. Logical rules are not imposed as are some rules of say grammar but are derived by collective interaction through common work and verbal exchange. Relativity is key in that it establishes the relationship between the self and the world of reality outside the self. The growing child perceives more and more of the outside world, relates, combines these perceptions in successive, interdependent, evolving operations, reaching a series of compensations with the former state. Piaget's use of dialetics is what he calls equilibrium. Equilibrium is the dynamic of the progression which Piaget outlines in the quoted passage.

He defines genesis as "a certain kind of transformation which stems from State A and results in State B, where State B is more stable than State A." The first characteristic of equilibrium, then, is that it is stable; it is, however, mobile, a series of actions. It is also subject to external intrusion. There is equilibrium when the intrusion is compensated by the actions of the subject. Finally, it

is active; the greater the equilibrium, the more the action. Thus the various stages through which the child passes from birth to maturity are major states of equilibrium; within these stages are what might be called secondary states of equilibrium, each state more stable and more active than the one preceding and having its genesis in it. What causes the transformation is the need of the subject which comes about by a widening perception of reality, the general world, the world outside the self, the inevitable though variable socialization of the individual.

It should be clear to those who have struggled through to this point that I am no psychologist, let alone epistemologist. Any attempt to reduce Piaget's thinking to these few pages is bound to be nothing short of ludicrous. I have of necessity not touched on the fascinating practical experiments by which Piaget's thoughts are arrived at and illustrated. What I have tried to do is to concentrate on those elements which should be of interest to the secondary teacher. There has long been a conflict of views between affective and cognitive education, roughly between what a person takes in through the pores, through emotion, through intuition and what a person is taught through the intellect. Piaget dispels this dichotomy. He says that a person feels a need stimulated by the world around him and instinctively reaches out but that the intellect forms the systems, structures, on which the various stages of equilibrium depend; in other words, affectivity and cognition are integral parts of the same process. However, the activity which determines the mental growth of the infant to childhood to adolescence to adulthood begins and ends within the individual. Teaching the results, he says, will speed but not introduce the operations on which growth depends. The child must feel the need before there can be any activity. The need comes from the child's contact with his environment. To the extent that school or schools constitute the environment, the mission of the teacher becomes quite clear.

The ages assigned to the various stages are neither sacrosanct nor rigid. Nothing inevitably happens at two or seven or twelve.

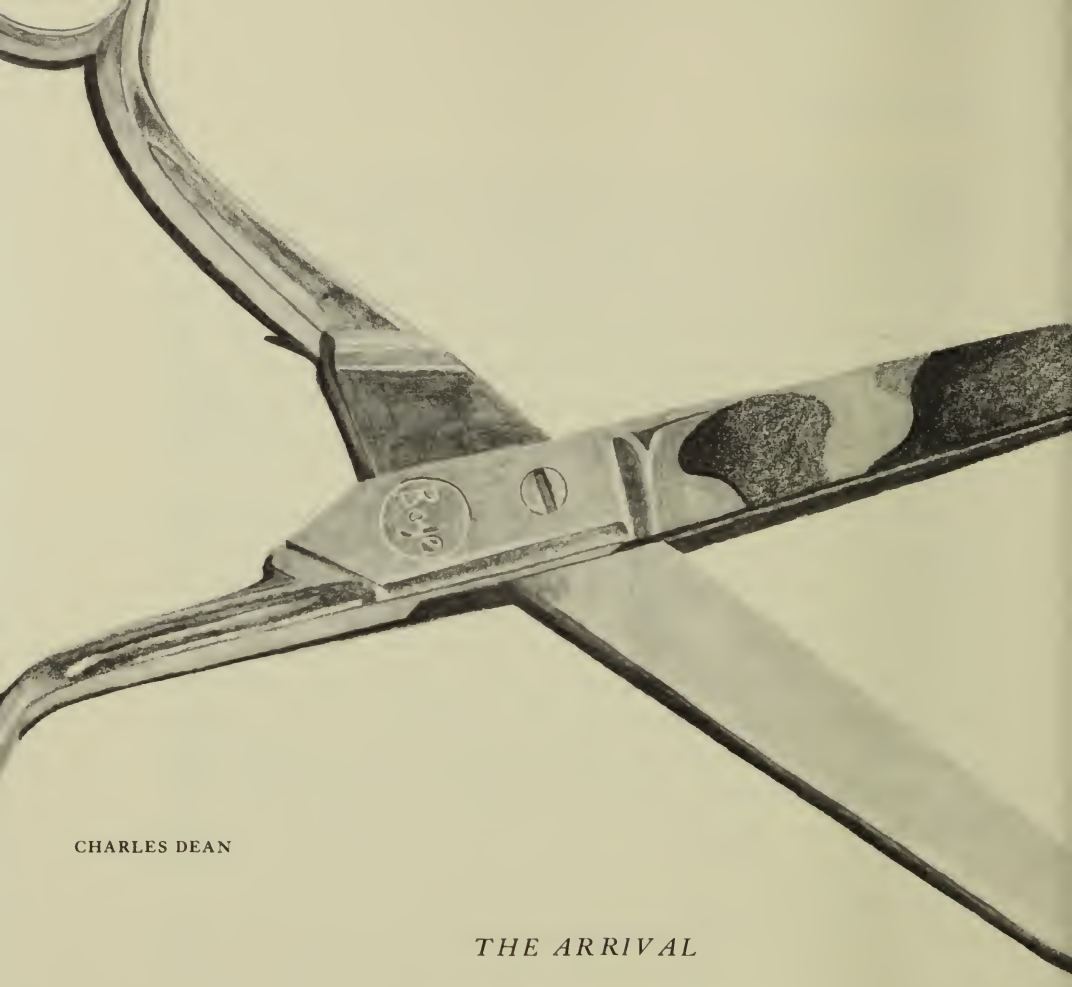
The operations characteristic of the stages and the gradual transformation from stage to stage and the equilibria within the stages are what are important, not to say vital, to the teacher and to the student. Since we are embarked on a symposium on how adolescents learn, the transformation from late childhood to adolescence, from concrete operations to formal and abstract operations, from thinking determined by the practical and the concrete to hypothetico-deductive thinking is the crux. Those who teach in secondary schools certainly can not assume that the physically adolescent students they meet in their ninth grade classes are capable of and inclined toward abstract thinking characteristic of the fourth stage of mental development. When a teacher finds a student incapable and disinclined to deal with hypotheses and to reason free of concrete controls, he must discover where the student is on the scale of concrete operations and start from there. He must devise courses and methods that will create a need for hypothesis and deduction and thus make possible the transformation from stage three to stage four. Once the student is well launched into mental adolescence, then it becomes the function of the teacher and the school to bring the world as it is (reality) to the student or to provide ways by which the student can get to reality so that the student may make the necessary compensations which lead to what may be called an adult equilibrium.

The adolescent's hypothetico-deductive activity is directed not only to the social world but to himself; he creates a life plan from which comes personality. This personality is an objectifying of the egocentric self, "a kind of decentering of the self." Since it is the result of hypothesis and deduction, the student must again make the adjustment to reality. Whatever the secondary teacher can do to help the student in making this adjustment possible he should do, always recognizing that the process is a response of the student to a need which originates within the individual and reaches an equilibrium there.

In his reference to the life plan, Piaget makes the only distinction I have been able to find between male and female: "Undoubtedly,

the life plan of young girls is more closely linked to personal relationships, and their hypothetico-deductive systems take on the form more of a hierarchy of affective values than of a theoretical system. Nevertheless, they are also concerned with a life plan that goes far beyond reality. If their life plan is more concerned with people, this is because the life for which they are preparing is more concerned with specific interpersonal feelings than with general emotions." I leave this statement to the reader to do with as she or he will.

Finally, if Piaget does not stop at age fourteen, as commonly supposed, he does not extend his stages beyond adolescence. He does, however, imply that the child is father of the man, that one can understand adult operations by understanding the evolution of the childhood operations. He also makes the point that there is no reason to suppose that there is not or can not be continuous development through adulthood. What is important for the teacher in secondary education is his feeling that the nature of adult thinking will be determined by compensations reached during adolescence.



CHARLES DEAN

THE ARRIVAL

The river has cut a new path.
I know where I'm going,
following it, though
I was here just once before
when the trees were brown.
I can also track birds
to their nests: I know the colors
they take when they think
of home, and how
their feathers lift just before
entering. Here everything
is probable. The leaves
have already turned their faces
to the sun, and this is still
the beginning.

SUSAN LUDVIGSON

THE WASTES

Life is clammy, the shepherd said,
and gives off an odor of medicine.

The closer we come to what we want,
the more ordinary it becomes. The less

desirable. Eventually it sickens,
filling our heads with grey boredom.

All excitement deadens from the inside out,
and finally leather rubs against leather:

Life risen to its own surface uglier and wiser.
Then what is the answer? the animals wondered.

Pain, labor, frustration and desire,
said the shepherd, all conspire

against the monotony of our lives.
It is this constant effort that erodes

the tedium and casts it afloat, an island
in the fresh, bedazzled and heavenly ocean.

LITERATURE

The shepherd read from the book.
The animals shook. Why can't they say

What has to be said? they said.
They gum it up with themselves.

All that style and bombast.
Meaning! We want something we can use!

Something spare, sensible and mystical.
Something absolutely intelligible.

A gem. Of value again and again.
A stone that can be worn.

RICHARD GROSSMAN

Rebalancing Balances

Piaget and Personality

ROBERT GRAHAM KEGAN

Woody Allen says he was thrown out of college for cheating: during a Metaphysics exam he looked into the soul of his neighbor. This kind of metaphysics is what I understand psychology – *psyche* and *logos*, a reckoning of the spirit – to be about. Its first aim is always to understand something *fundamental* about us. The psychologist, as I would have him or her, does not lose sight of the fact that his activity is intrinsically philosophical, the examination metaphysical; but he is wary of self-deception and so he "cheats" – he looks into the soul of his neighbor for verification.

When Freudianism proved unable to deliver empirically on its promise of explanatory power, the field of personality went into decline. What was once, under Freudian influence, a proud, theory-guided investigative discipline has now come down to something more like an atheoretical nomological entrepreneurialism. Were the work of the most recent generation of psychologists all we had to go on in seeking a meaning for the very word *personality*, we should have to call it, Jerome Kagan says, "variation among individuals in locally valued traits," rather than make references to any whole or dynamic system or process (personal

(Abstracted from a doctoral thesis entitled "Ego and Truth, Personality and the Piaget Paradigm.")

communication). The enterprising researcher concentrates on some supposed "trait," "drive," or "motive" whose meaning comes to be defined by that which his research instrument quantifies, and whose usefulness comes to be defined by the breadth and nature of its correlations with similarly constructed variables. Does your instrument give you variability across subjects and stability within subjects? Then you're in business – but business is not metaphysics, much less a metaphysics that cheats, and so we are left with a psychology whose gaze is neither out far nor in deep. It neither reaches back to a philosophical source, nor forward to explore the person in his or her organizational wholeness.

A vigorous psychological theory – especially one which passes into our "cultural symbolic" (Rieff, 1966) – usually generates a crystalizing image or scene, some powerful evocation of that psychology's methodology and undergirding epistemology. In 1959, Robert W. White urged a new image to add to that of "the hungry animal solving problems, the child putting his finger in the candle flame, the infant at the breast, the child on the toilet, and the youthful Oedipus caught in a hopeless love triangle." White drew the image he urged from the rich and scientific attentions Jean Piaget directed to children. Piaget's observations yield an image of the child acting dynamically on a world acting dynamically upon him; of a selective, interpretive, directed, constructive, and persistent organism literally "making sense" of the universe; of one who not only changes behavior as a result of experience (the classic definition of "learning"), but changes experience as a result of behavior; as involved, thus, with knowing as with learning; in short, an image of the child as philosopher.

Now Piaget's image has certainly not been ignored. In the eighteen years since White's essay Piaget's influence has grown from that accorded a charming old man sitting on the shores of Swiss lakes talking to children about the wind to that of a man whose program of work is taken as the very guide to universally regular features in intellectual development from birth to adolescence. School curricula and learning settings, increasingly, are organized in the light of his discoveries about the different realities

children live in and construe; and educational goals are partly fashioned in terms of facilitating the development he describes.

Yet eighteen years from now it is more likely that "Piaget" will be "about" "cognitive development" only in the way Columbus is "about" discovering the West Indies, or Newton gravity, or Jefferson reconciling the claims of the individual with the claims of the state, or Joyce a literary approach to consciousness. These are the "problems" that consumed these men, and they resolved them brilliantly, but so brilliantly that the resolutions became Trojan horses lying in wait to reveal what they were really about. Coaxed out of the fortress of our established habits of mind by the interesting figure on home territory, we look into the matter only to have it explode upon us, an army spreading all around, capturing the fortress which becomes figure upon it. What was but a dazzling construction on familiar ground becomes the new ground itself as a new geographic, scientific, civil, or aesthetic grammar is articulated. Columbus' voyage changed the shape of the world. He may have discovered America, but in doing so he caused to be *rediscovered* every other part of the world as well. His discovery, initially of just another "part," was of that extraordinary sort that "re-cognizes" the relationship of the parts to the whole.

What Piaget really studied is the way the changing subject-object differentiations organize and reorganize the person's construction of the physical world. He describes a sequence of balanced structures (or "systems of knowing," or "equilibria" or "stages") which organize and reorganize the physical world by distinguishing between what is subject and what is object in the direction of increasing objectivity. The infant, for example, is adualist; there is yet no differentiation whatever between "self" and "other." Given all we have labored to say about the essentially fictive quality of the "self-other" differentiation, are we not then bound to declare the infant's adualism the truest conception of the world? Is he not *knowing* the oneness we have said hangs continually behind our illusory constructions? It is important to see how he is not. The infant is an adualist not because "self"

and "other" are one, but because he is *all* self."[1] The infant is completely "subjective"; i.e., the entire world is *subject to* his perception of it for its existence –from the point of view of the infant. But this is just the point: the infant *has* a point of view that *is* "his." Even in an adualist there is a constituted "self" that is knowing the world adualistically. The infant's adualism is not the sort in which one's own and the world's point of view come together, or are completely reversible; rather there is yet no "world's point of view" to be taken at all. The developmental career is the qualitatively increasing understanding of a "world's point of view" for the "self" to take in its knowing of the world. From the point of view of the equilibrative whole – i.e., the universe – each individual developmental advance amounts to more completely joining the world, of more harmoniously integrating it. The way we love the world is by knowing it.[2]

Sometime in the second year of life such a qualitative development – a subject-object rebalancing – takes place; in this case it is the very creation of the "object" itself; thereby the organization of reality becomes more *objective.* This construction of what Piaget calls "object permanence" (1936) – the recognition that

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[1] "Adualism" is a tricky word, and much confusion, particularly "theological" confusion, results from failure to recognize at least three different meanings for "adualism": it can mean "self" and "other" are one; but "all 'self' " (as in Freud's infantile "oceanic experience") and "all 'other' " (as in the popular notion of "transcending the ego") are also "adual."

[2] This conception of development, then, as an increasing separation of "self" from "other" should not be taken to suggest a steady *withering* of the individual's relationship to the world, but a steady strengthening and complexifying of that relationship by means of seeing more and more clearly what is me and what is not me. Declaring something to be not-me does not eliminate it as an object of attention or affiliation; on the contrary, it *creates* it as an object of attention or affiliation. Piaget's conception of growth as successive "decentering" of "self" from "other" is, thus, not a matter of *separation from,* so much as *distinction between;* not distance, but declension. (If affiliation is literally a matter of "making into a son," then Piaget's conception of growth as decentering is indeed a matter of increasingly extensive affiliation. It is an affiliation, however, from an opposite direction than the one to which we are accustomed. I.e., that with which we become newly affiliated is not a stranger now made intimately familiar, but something which was "too familiar" – i.e., confused with the "self" – now seen as *separate from* but in intimate *relation to.*)

objects exist independent of my perceiving them – reorganizes the knowing balance in such a way that the world the child construes is no longer subject to the child's immediate action-sensations. The infant adualist knows by its activity in the world. Its mind *is* its body. This is the essence of what Piaget calls the "sensorimotor" stage (1936); it senses *by* action. With the ability that comes in the second year to represent in memory its activity, the infant gets unimbedded from its "motor-sensing" and comes to have what we might call "perceptions." When the pretty ball the eighteen-month-old child was handling is covered with a blanket, he can apparently imagine it still existing under the blanket although he can no longer see it; how else can we account for his deliberate uncovering of the blanket to recover it? Prior to the development of "object permanence" the child ceases to involve himself with the ball when it is covered, not because he just "loses interest" in it (one need only uncover the ball to see that this is not the case), but apparently because *it* loses *existence* for him. What is really happening in this new way of knowing is that rather than being embedded in one's sensing-by-action, being *subject to* sensing-by-action, one's sensing-by-action "moves over" in the knowing-balance from subject to object; one's sensing-action becomes the *object* of one's experience and a new "self," a new *subject* is evolved. Where previously "I" *was* my sensing activity I no longer *am* it; rather it is something I *do* or *have*. What "I" *am* is that which *coordinates* action-memories, i.e., my *perceptions*.

But notice now that there is a new embeddedness. Every developmental advance (and this *is* an advance, not just a shift in balance, because it is a shift in the direction of greater objectivity) is a triumph over the subjectivity of the past, but a constraint of mind with respect to potential advances to come. Hence the three-year-old constructs a world of objects which exist for him or her independently of his or her sensation of them; this much of the "world's point of view" the newly constructed "self" can take. But a measure of that "self's" remaining subjectivity is demonstrated by the fact that the properties of objects are seen to change with one's differing perceptions of them. One is embedded in, or

subject to, one's perceptions, now, as before one was embedded in one's action-sensations. For example, in Piaget's classic study of the conservation of quantity (1937) two identically shaped beakers are filled with equal amounts of water. When the contents of one of the beakers are poured into a taller, thinner beaker (resulting in a higher water level than the remaining beaker) the taller, thinner beaker is said (usually) to have more water. Anyone's first reaction to such an "error" is to pour the contents of the taller, thinner beaker back into the original beaker. When the levels match once again the child will certainly see that the contents of the poured beaker are equal to those of the unpoured beaker. "Yes," the typical child may say, "they are equal – now!" When the contents are poured once again into a shorter, wider beaker, they become less than the contents of the remaining beaker, and so on. Now just what is going on here? Piaget's experiments are so brilliant (Einstein said they were so simple they could only have been thought of by a genius) because they transform such an abstract notion as "structure" or "the subject-object differentiation" into something almost palpable. The child is embedded in his or her perceptions; he is *subject to* them in his construction of reality. Pouring the liquid back in the original beaker does not automatically lead the child to see the error of his ways because he is unable to separate himself *from* his perceptions. They *define* the "self," the subject of one's attentions. But these perceptions "move over" to "other" in the rebalancing or stage change to what Piaget calls "concrete operations" (usually beginning around four to seven years). Now one is able to take one's perceptions as an *object* of attention; no longer subject to them, one can co-ordinate his perception at $time_1$ with his perception at $time_2$ and see that the quantity remains the same (or one can co-ordinate his perception of a thinner beaker [therefore less water] with his perception of a taller beaker [therefore more] and see that the changes cancel each other out). As with every rebalancing, what had been taken as "self" is recast to the domain of "other." "I" am not my perceptions; rather, I *have* perceptions; my perceptions become the object of my attention, co-ordinated by what *is* "me,"

the new "self," the new subject of "my" attention. And what that new "self" is – the precise nature of its co-ordinating – is a conservor of the physical world. Its capacity to construct reversibilities of groups and classes permits it to "hold" the concrete world, to know it in its concreteness. The child is now embedded in the concrete.

When the concrete operational child is presented, e.g., with four beakers of colorless liquids and asked to figure out how to make a yellow liquid by mixing some number of some of the liquids, he proceeds haphazardly, hoping to hit upon the solution (Piaget, 1937). There is no "overall plan" in evidence. Or he may be presented, e.g., with a group of metal rods that differ in all possible combinations of material, length, diameter, and shape of cross-section, and be asked what makes one rod more flexible than another. He may experiment and declare that length is a factor, demonstrating his point with a long, *small-diametered* rod and a short, *large-diametered* rod. Asked about the differences in their diameters he is likely to say that he chose them to make more emphatic the effect of differing lengths. Now what is happening *here?* Continuing with our way of articulating Piaget's findings, the "concrete" child has no "overall plan" that constructs all possible ways of mixing the colorless liquids, does not isolate a single variable while holding all other factors constant, because he is *subject to*, or embedded in, the concrete in his construction of the physical world. An "overall plan" that takes as real concrete events which have not yet happened requires a way of knowing the world in which the concrete "moves over" from subject to object of attention. If the reversibilities co-ordinate (take as "object") the perceptions for the "knowing balance" that is "concrete operations," it is the co-ordination of the reversibilities themselves that distinguishes the qualitatively more objective balance that is "formal operations." It is the construction of what Piaget calls the "inverse of the reciprocal," co-ordinating the before-separate reversibilities of the "negation" (which, e.g., co-ordinates $time_1$ with $time_2$) and the "reciprocal" (which, e.g., co-

ordinates thinner and less with taller and more), which brings about the new *subject* of the "self's" attentions – the INRC group (Piaget and Inhelder, 1969). This new "self" can now construe the world propositionally, hypothetically, inferentially, abstractly. It can spin out an "overall plan" of which any given concrete event (a combination of beakers, e.g.) is but an instance. Put most simply, this new balance makes "what is" a mere instance of "what might be." This rebalancing, the hallmark of adolescence, unhinges the concrete world (and, necessarily, the old "self" previously embedded in the concrete), and makes the concrete an object of a new "self" which is meta-concrete, meta-physical.

We have seen then, in this new casting of Piaget's findings, how they might be taken to describe a successive rebalancing of subject and object as the person comes to *know* with increasing objectivity the physical world. In sum: it is the rebalancing which "moves" the action-sensing of the infant from subject to object that leads to the first equilibrium, an equilibrium that makes "self" and "world" *subject* to the perceptions which co-ordinate action-sensing; it is the rebalancing which "moves" the perceptions from subjet to object that leads to the next major equilibrium, an equilibrium that makes "self" and "world" *subject to* the reversibilities (or "the concrete") which co-ordinates the perceptions; and it is the rebalancing which "moves" the reversibilities (or "the concrete") from subject to object that leads to the next major equilibrium, an equilibrium that makes "self" and "world" *subject to* the hypothetico-deductive (or "the possible"), which co-ordinates the reversibilities (or "the concrete"). The table below – a risky procedure, because it cannot capture the qualities of *process* and *unity* which are essential to a concept of equilibration – schematizes the character of these developments in our balance-striking. In psychoanalytic terms, *every* qualitative differentiation is a correction of something like global introjection; only the newborn is seen to *begin* life in a state of whole-world introjection, and development involves a succession of qualitatively reorganizing discoveries to the effect that I have been defining the

SUBJECT-OBJECT BALANCING IN PIAGET'S STAGES OF COGNITIVE DEVELOPMENT

Stage	Subject ("structure")	Object ("content")
Sensorimotor	Action-sensations	None
Preoperational	Perceptions	Action-sensations
Concrete operational	"Reversibilities" (the "actual")	Perceptions
Formal operational	"Hypothetico-deduction" (the "possible")	"Reversibilities" (the "actual")

world too much from my own point of view, that what I was taking for me is *not* me, but "other"; a succession of decreasing subjectivity and increasing richness or complexity to the relationship of the "self" in the "world"; a succession that binds growth to truth.

* * *

Obviously these subject-object differentiations have implications for the knowing of the *social*, as well as the physical world. Matters beome more complex, however, because the "objects" include persons, and while persons share those constitutive dimensions of spatiality, temporality, causality and materiality with drops of water and long metal rods, they have the additional feature, as we have said, of consciousness. Piaget sees the constructions or equilibria of his stages arising out of the interaction of the constitutive tendencies of the individual and the constitutive tendencies of the environment. These are universal tendencies; every environment is causal. It should be clear by now that there is a danger to Piaget's formulation. It gives an impression of a worldless constitutive human meeting a selfless constitutive world. This now-common way of putting the matter once again makes a cylinder "two ends

connected by a glass tube." The constitutiveness of the "individual" and the "environment" are, in some sense, one. In our own terms, it is not so much the "self" that is constitutive as the person (the "self" is the person's *constitution*) and the person is that unitary equilibrative activity viewed from the perspective of human beings. What distinguishes "personality" from "tree-ality" is precisely the capacity of human beings to construct a "self." Development of social-knowing differs from the development of physical-knowing precisely because the objects of personality's social knowing themselves have personality. Social-knowing theorists (Kohlberg, Selman, Fowler) have perhaps not made as clear as they could what exactly *is* the *social* analog to Piaget's universally constitutive "environment." Social-knowing development differs qualitatively from (or, actually, qualitatively builds upon) physical-knowing development in that the social environment, in addition to being constitutive in the same ways as the physical environment, is constitutive in the manner unique to persons. The social environment is itself "conscious." Trees "structure back" upon the human being by being spatial, temporal, causal, material; other people "structure back" by being all of these and, additionally, themselves self-conscious construers. This distinction takes on a practical significance when we consider that disequilibrium in social-knowing cannot be looked at only from the point-of-view of a single subject, but must be seen in terms of the social environment's re-cognition (and re-affection!). But the point is made here in order to make clear that development in social knowing, which like all development means an expanding "world's point of view" for the "self" to take, must mean a developing consciousness that the "world's point of view" is itself self-conscious.

This sense of social development as involving a successively reconstructed capacity to take the role of the "other" is at the heart of the work of George Herbert Mead (1934), Lawrence Kohlberg (1969), and Robert Selman (1974). What I would like to do in what remains of this article is indicate how Kohlberg's theory – like Piaget's – can be recast or understood in the context

of this ongoing equilibration and re-equilibration of subject and object. In the process, I hope to be able to indicate, not merely the meta-theory of ego development from a constructive-developmental point of view, but actually to indicate the shape of the several global "ego-balances" along the way. We have suggested that Piaget's program has given us a sense of the person's developing knowing of objects, a knowing oriented to what is *true*. Kohlberg's program gives us a sense of the person's developing knowing of "people-objects," a knowing oriented to what is *right* (moral development). What I think we will see is that Kohlberg's moral knowing is itself rooted in a developing conception of what is true and that it is this bigger context out of which his theory springs that should comprise "ego development" from a constructive-developmental point of view – e.g., the developing knowing of other "selves" oriented to what is true.

Kohlberg's theory of developing constructions of the ethical can be understood, like Piaget's, in terms of a dynamic equilibration of subject and object. Like Erikson's stages, each successive stage is a greater differentiation of that relationship; unlike Erikson's stages it is the process of equilibration itself, the ongoing activity of assimilation and accommodation in the world – not the internal reassignments of binding energy – which is taken to lead to the qualitative stage changes. For the interactionist growth is a consequence of making meaning and not the other way around.

With the concrete operational child's capacity to coordinate his perceptions in space and time (to shift his perceptions from *self* to *other*) comes the Piagetian reversibilities of inversion and reciprocity. These permit me to see, e.g., that the apparently diminished quantity of liquid in the bigger glass is really the same amount because "you can just pour it back into the smaller glass" (inversion) or "the level is lower, but it's also wider, so it's the same" (reciprocity). These operations, or this new equilibration of subject and object, also create the possibility of a similar social construction, for which the prior logical construction would be

necessary but not sufficient (Kohlberg, 1969; Selman, 1974). We can better imagine what this would be by seeing that the corresponding physical reorganization, which permits me to take my perceptions as an object of my consideration rather than as my consideration itself (subject), involves the capacity to *take the role of* my perceptions. Where before the act of pouring the liquid (to continue with this example) was an act with literally incalculable consequences, leaving my interpretation at the spatial-temporal surface (the "apparent" at $time_1$ and $time_2$), now my operational organization permits me to "get behind" the data, to "come in" along with it. The social correlate is the new capacity to take the role of another person, which permits me to "get behind" my perceptions of his acts so as to understand, or at least consider, the actor's *intentions* (Selman, 1974). This new capacity is reflected in the shift from Kohlberg's first stage to his second, or in Piaget's understanding of a shift from "heteronomous" to "autonomous" morality (Piaget, 1965). An example of how this shift manifests itself in ethical construction is children's understanding of this type of story which Piaget told preoperational and concrete operational children: one little child was explicitly told by his mother not to touch the fragile cups and purposely picked one up and smashed it to bits on the floor. Another little child was not told anything about not touching the cups, and, to help his mother, tried to carry a tray of twelve cups where she needed them, accidentally spilling all of them to the floor where they were smashed to bits. "Are these children equally at fault?" or "Which of the two children is the naughtier, and why?" Children tend to orient not at all randomly to the story according either to the *result* (the data taken at the surface), or the *intention* of the actor ("coming in" with the data); that is, preoperational children, to the former, and concrete children to the latter. In the social context the ego's knowing activity is inevitably a valuing one as well.

But as every structural-developmental stage is both a triumph over the truth-limits of the prior stage, so it is a constraint of mind with respect to the successive differentiations to come. The con-

crete operational child who has constructed the reversibilities of classes (inversion) and of relations (reciprocity) cannot yet coordinate these two kinds of reversibility to construct the "inverse of the reciprocal" (Piaget and Inhelder, 1969), cannot yet "move" these reversibilities from defining the "self" "over to" an object of the (new) "self's" attention. Similarly, at a socio-moral level, one can take the roles of others, but one cannot coordinate two perspectives each to the other; i.e., one cannot take one's own role from the other's perspective. Until I can do this the "self" is embedded in, and defined by, its own wants or needs. "I" *am* my needs, interests, desires, and other people are seen as theirs. Interpersonal relations are a matter of "deals." Life itself, your life, for example, is of value to me insofar as it is of benefit to me, just as I assume my life is of value to you insofar as you derive some benefit from it. "This is the way the world is."

By way of example, I will report an early teaching experience with seventh graders. I assigned them the much-anthologized short story, "The New Kid," by Murray Heyert (1967). The city block and the nearby playing field form the universe of the story, which opens with the choosing of sides for baseball. This holy ritual is a humiliating one for Marty who is always chosen last and relegated to the outfield. Here the religious exercises continue with his prayer that no ball leave the infield. But, as it happens, the gods do not smile, and at the crucial moment the ball soars toward Marty, who, sprouting extra arms, fails the chance and costs his side the game. As he trudges in from the field, a round of abuse is fired upon him.We get the impression that this is not only an awful experience for Marty, but a rather common one. Some kids are just lucky.

Then one day a new kid appears on the block. He's little. His clothes are too nice. His socks match. There are buckles on his shoes. In other words, he may be more of a wimp than Marty. He is invited to the ballfield and sides are chosen. For the first time Marty is not the least favored. As luck (and artistic license) would have it, the new kid must handle the crucial, last inning

blow. He fails spectacularly – not merely at catching it, but at running after it, grasping it, and throwing it. He is not Willy Mays. He returns from the field with his chin on the ground, and who should begin – who should *lead, who should sustain* – the round of humiliating invective, but Marty himself.

Now I asked my twelve-year-old students the moral of this story (though I doubt I used this word), and their answers ran something like this:

> The story is saying that people may be mean to you and push you down and make you feel crummy and stuff, but it's not really all that bad because eventually you'll get your chance to push someone else down and then you'll be on top.

From these angelic faces this recurring response flabbergasted me. Not so much because everyone seemed to agree it was what the story was about, but because it seemed no one could even *invent* – even if they didn't believe it – what I took to be the obvious moral of the story. At first I thought they were teasing me, boasting perhaps, acting "hard." "Do you *really* think it was okay the way Marty acted?"

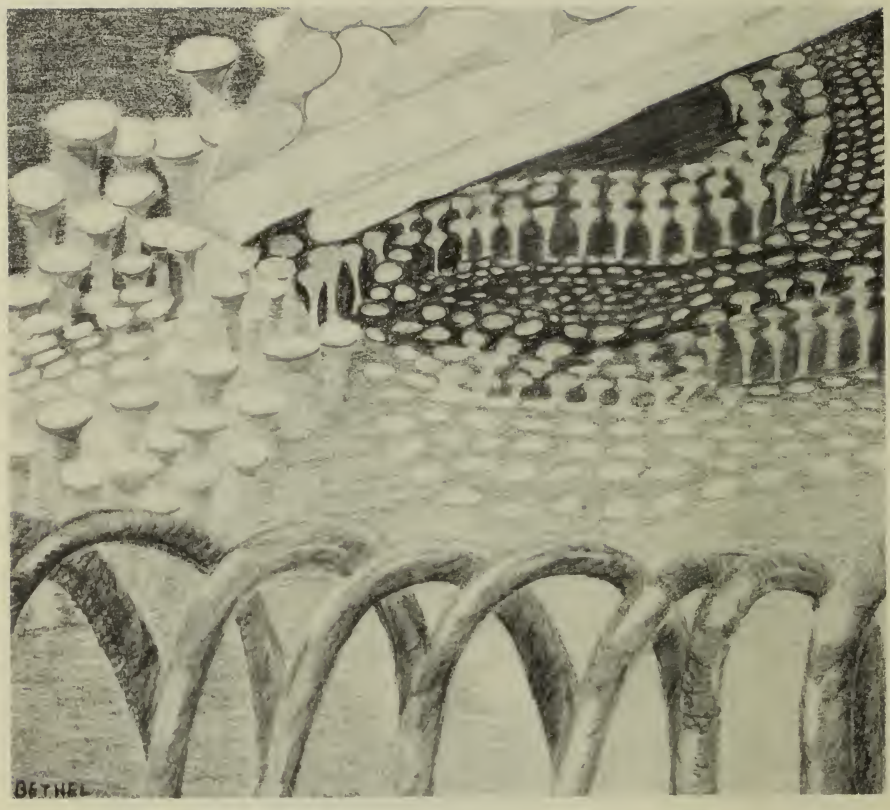
> It was more than okay; it was the right thing to do.
>
> It was the only thing to do.
>
> Look, we were sixth graders last year, right? the oldest in the school. We pushed the little kids around. Now we're the little kids and we're getting pushed around. Wait 'til we're seniors! Fair is fair!

It seems clear we are looking not so much here at *what* kids know, but *how* they know. And how the child knows in the balance Kohlberg calls stage 2 does not permit even the possibility of understanding the story as we do. But as persons move out of a concrete operational, non-mutual role-taking world, typically at early adolescence, we would expect them to be able to reject a notion of the right which is itself *founded* on the recognition that each person is his own needs, while at the same time not rejecting an understanding of needs themselves. That which before was the

very context or axis of ought-making is subordinated, made figure instead of ground, reintegrated into a new organization which further differentiates the subjective from the objective. The needs themselves become objective; instead of *being* my needs, "I" *have* have needs, as do others. My capacity now to coordinate (integrate) one person's needful perspective with another leads to something quite different than the former dog-eat-dog morality. People are still seen to have their own needs, but, in being able to coordinate one perspective with another, competing needs can be resolved by, and subordinated to, the requirements for maintaining mutual interpersonal relationships, the new social construction of this "self-other" differentiation, and the new subject of attention. The adolescent is thus literally making sense of the interpersonal relationship, whose strictures were before as bewildering to him, as his inability to hold up his end of one was maddening to those who may have thought he was old enough to "know better." Here is a twelve-year-old boy who is just getting hold of this new construction:

> [after saying that what is bad is what causes people pain] (Why is causing them pain bad?) Well, that's what I've been taught. Um – some other people have been taught a bit different – that what's bad is to do anything unfair. You know, it's fair to draw all over their things because they'd drawn all over yours. That's good, that's good to do. But I think no matter what they've done to you, it really doesn't matter. The point is that it gets done, so what?

As a child making the same discovery said to Piaget (1948), forgiveness is preferable to revenge, not because of some Sunday School sermonizing, but because "there's no end to revenge."



STARLENE BETHEL

Measuring Maturation

Myelinogenesis and Brain Function

PETER H. WOLFF, M.D.

Comprehensive accounts of psychological development agree in principle that biology and experience are always reciprocally determined vectors and that their interaction can never be entirely isolated in clinical assessments or experimental design. In the conduct of concrete experiments, developmental psychology is therefore inclined to apply a strategy of "holding one vector constant" while investigating the effects of the other — a strategy which is productive when it alternates between observations on biological phenomena and on the influences of psychological experience to explain behavioral development. In practice, however, empirical research in developmental psychology has generally neglected the biological vector, concentrating almost exclusively on experience as the sufficient cause to explain developmental variations.

Where developmental psychology recognizes biological maturation as an important variable, it has usually applied chronological age as the independent variable, thus making the tacit assumption that maturation is as uniform in its relation to physical time as chronological age. Yet Wohlwill (1973) has persuasively argued that chronological age is an artificial measure based on physical rather than biological time. He suggests that the circular conclusions which result from the use of chronological age as the independent variable of development can be circumvented if we substitute physical or psychological growth measures. Tanner's studies

[1] Taken in part from a report on child therapy from the Mental Retardation Research Center, The Children's Hospital Medical Center, Boston, Massachusetts. Printed by permission of Brunner Mazel, New York.

on physical development (1970) demonstrate how greatly children of the same chronological age may vary in maturational state; and like Wohlwill, he recommends physiological indices of maturity or "developmental age" as the preferred independent variables. Very few biological measures of maturation, however, have been shown to relate specifically to the development of behavior. Skeletal growth curves are a useful first approximation, but their relation to brain maturation is indirect and their relevance for psychological development has been demonstrated only in correlations. Direct measures of human brain growth are not sufficiently precise at present to reveal how the maturation of brain functions determines specific aspects of behavioral development (Purpura, 1973). Despite an enduring debate about the relation between myelinogenesis [sheath around nerve fibers] and brain function (McKhann, Coyle & Benjamins, 1973), central nervous system myelinogenesis probably provides the best overall map of regional variations in human brain maturation that is currently available. The meticulous morphological studies by Yakolev and Lecours (1967) and Rakic and Yakolev (1968), for example, indicate that major inter- and intrahemispheric association pathways do not complete their growth until some time between 4-12 years. Assuming that myelination is an indirect clue to the onset of function, it should follow that maturation influences behavioral development throughout infancy and childhood, particularly as development is influenced by the progressive lateralization of cerebral functions and by increased inter- and intrahemispheric coordinations (Trevarthen, 1974)....

The study of behavioral outcome after pathological growth retardation demonstrates the interactions between maturation and mental development most dramatically. By itself, however, such evidence does not constitute a secure base from which to draw conclusions about maturational factors in normal mental development. Clinical psychiatry provides many examples where extrapolations from the pathological to the normal case have led us to draw erroneous conclusions. In the case of maturational variations,

such extrapolations may cause us to label as deviant or pathological those normal biological variations which conflict with arbitrary social expectations and motivate us to impose elaborate enrichment procedures in order to homogenize children according to some arbitrary social criterion (Wolff, 1972). We must therefore also find models that demonstrate the effects of maturation on normal behavioral developmet.

The analysis of behavioral sex differences can, I believe, provide such a model. On the average, girls are physically more mature than boys throughout the period of childhood and adolescence. Although the differences are more evident during periods of rapid growth, such as the prepubertal growth spurt (Tanner, 1970) or the "5-7 shift" (White, 1970), similar sex differences in physical maturity are already evident at birth. Newborn girls, for example, are 4-6 weeks advanced in skeletal age and remain at about 125% of male skeletal age until the are sexually mature (Tanner, 1961). Differences in skeletal or sexual maturation are obviously not direct correlates of sex differences in brain maturation or behavior. The enormous regional variations of normal central nervous system maturation makes it very unlikely, in fact, that any single behavioral or psychological measure would adequately reflect "brain maturation." On a more limited scale, however, Witelson and Pallie (1973), for example, have shown that selected structures of the left cerebral hemisphere associated with language processing are morphologically more mature in newborn girls than boys. From a comparison of sex differences in behavioral outcomes among children with early left or right temporal lobe seizures, Taylor (1969) also concluded that the left cerebral hemisphere matures earlier in girls than boys. Finally Goldman and her associates (1974) observed significant sex differences in behavioral outcome of infant mammals after surgical lesions of the frontal lobes, from which they could infer sex differences in the cerebral maturation of non-human mammals.

The study of human differential abilities provides more extensive but less direct evidence for sex differences in the maturation

of cortical functions. Infant girls as a group attain verbal fluency earier than boys of the same chronological age and retain this developmental advantage until adolescence (Garai & Sheinfeld, 1968); girls perform better than boys of the same chronological age on tasks requiring verbal fluency or speed and accuracy on automatized motor skills (Broverman, et al, 1968; Wolff & Hurwitz, 1976). Whether such behavioral sex differences are "real" or experimental artifacts, and if real, whether they are biologically or culturally determined remain issues which are actively debated (Maccoby & Jacklin, 1974). Any assessment about the merits of this debate must, however, take into account the behavioral sex differences are very sensitive to developmental effects, some differences decreasing as children approach puberty, others not appearing until the onset of the adolescent growth spurt, still others increasing from childhood into adult life. Many inconsistencies in the experimental literature on behavioral sex differences would probably be resolved if maturational factors and developmental changes were systematically considered in the evaluation of research findings.

The biological basis of behavioral sex differences is demonstrated more clearly on performance measures less confounded by cultural factors. They are reflected, for example, in the separate age norms given for boys and girls on the Lincoln-Oseretsky Test of Motor Maturity (Sloan, 1955), The Bender Visual Gestalt Test (Koppitz, 1964), and many other standardized testing procedures (Garai & Sheinfeld, 1968). Childhood behavioral disorders associated with neurological immaturity rather than neurotic conflict or brain damage, such as language and reading retardation, specific learning disability, minimal cerebral dysfunction, motor immaturity or developmental clumsiness, hyperkinesis and attentional disorders, occur 4-10 times as often in boys as girls (Bentzen, 1963; Eisenberg, 1966; Singer, Westphal & Niswander, 1968). A number of so-called "soft" signs of pediatric neurology are considered normal when they occur in young children and to have diagnostic significance only after a certain age. These dis-

appear significantly later in normal boys than normal girls, and also persist longer in children with minimal brain dysfunction, specific learning disability and hyperkinesis than in normal children (Connoly & Stratton, 1968; Hurwitz, et al., 1972; Wolff & Hurwitz, 1976).

Clinical and experimental evidence converges on the conclusion that specific biological parameters modify the development of normal and abnormal behavioral sex differences and that girls as a group are "programmed" to mature earlier than boys. Yet no comprehensive psychological theory of development has systematically incorporated biological mechanisms which might determine such differences in its explanatory formulations. I suggest that our knowledge about maturational mechanisms contributing to behavioral sex differences is sufficient at present so that studies which "control for" sex differences by limiting the study sample or that "control for" maturational rate by grouping children according to chronological age are likely to miss a crucial determinant of behavioral development.

The indisputable fact of sexual dimorphism does not, however, justify the assumption that males and females constitute dichotomous behavioral types. In cross-sectional and longitudinal follow-up studies, Ljung (1965) and Kohen-Raz (1974), for example, have demonstrated that even within sex the timing of the adolescent growth spurt is closely related to rapid changes of performance on mental tests. Early-maturing girls tend to have a slight but distinct advantage over late-maturing girls of the same chronological age on academic achievement tests (Tanner, 1961); and Epstein (1974) has reported significant within-sex correlations between rapid changes of physical brain growth and intellectual performance during adolescence.

Waber (1976) has added a new perspective to our understanding about the origins of behavioral sex differences, by comparing differential ability profiles in normal early- and late-maturing boys and girls. Early-maturing boys were found to show a typical "female" profile of differential abilities, late-maturing girls a "male"

profile. Group differences in cognition and perception which are generally attributed to sexual dimorphisms may therefore be explained at least in part by the fact that girls as a group mature earlier than boys.

The better performance of boys and men than girls and women on most tasks of spatial visualization, of mental rotation for spatial visualization and of visual or tactile pattern recognition (McFarlane-Smith, 1964; Witelson, 1974) suggests, moreover, that a "general growth factor" is not sufficient to explain the biological contribution to behavioral sex differences. The male advantage on most tests of spatial ability does not become evident until shortly before puberty, but in isolated cases it has been demonstrated as early as 6 years of age (Witelson, 1974). Co-twin variance studies (Bock & Vandenberg, 1968) and family pedigree studies (Hartlage, 1970) have shown that in addition to maturation, genetic factors contribute directly to sex differences in spatial ability, probably as a sex-linked recessive trait. Moreover, Broverman and his colleagues (1968) have shown that circulating gonadal steroids systematically influence the cognitive style of adults and that the same endocrine substance has a qualitatively different effect on males and females. We may conclude that no single mechanisms adequately explain biologically determined sex differences in behavior and that such differences are probably the residues of an interaction among genetic, direct hormonal and maturational factors, which exercise their effect in different ways at different stages in ontogenesis [individual growth].

The relation between brain maturation and behavioral outcome is obviously complex and susceptible to continuous developmental transformations. Any systematic endeavor to examine how maturation, independent of chronological age, codetermines behavioral development must therefore apply psychological measures which are based on knowledge of brain functions from a developmental perspective. Recent advances in neuropsychology have provided one set of analytical tools which, if properly modified for the study of children, should enable us to investigate the maturation of human

behavior in a precise manner. Although most of our information about human brain-behavior relations comes from clinical observations on adult patients with localized cerebral lesions, the concordance between such information and the data from experimental studies on normal children and adults justifies the conclusion that the two cerebral hemispheres are inherently programmed to mediate qualitatively different psychological functions and that hemispheric specialization does not differ quantitatively in children and adults.

Among right-handed individuals, the left hemisphere is "programmed" to process discrete language functions, the sequential features of nonverbal arrays (Carmon & Nachsohn, 1972) and the serial organization of motor actions (Carmon, 1971; Milner, 1972; Ingram, 1975; Wolff & Hurwitz, 1976). In contrast, the right cerebral hemisphere is preferentially organized for processing information in which visual-spatial features, pattern recognition and the instantaneous apperception of spatial relations are prominent. The bewildering array of discrete psychological tasks with a partial hemispheric lateralization which has been collated by experimental neuropsychology in recent years has motivated classification of lateralized functions in terms of functional "modes" rather than specific psychological tasks. Thus the left cerebral hemisphere has been characterized as processing by focal, analytic or serial strategies, the right hemisphere as extracting information by the diffuse, holistic, gestalt mode or by strategies of "parallel" processing (Taylor, 1932; Semmes, 1968; Cohen, 1973). Such characterizations are only a rough approximation of actual conditions, but they have the heuristic advantage of grouping a large number of heterogeneous psychological tasks under a few formal rules and of directing research efforts to a functional analysis of brain mechanisms. . .

The contribution of interhemispheric connections to the development of behavior remains a matter of debate. Kimura (1961) and Sparks and Geschwind (1968) proposed a structural model in which information is transferred between two intrinsically lateralized hemispheres. Kinsbourne (1975) has argued for a less

static model which assumes a bilateral representation of functions, a suppression of function in the "non-dominant" hemisphere by way of the corpus callosum and a fluctuating distribution of attention across the hemispheres according to task demands. Verbal stimuli, for example, bias attention toward the left hemisphere, and this distribution of attention influences the mode in which information will be processed. When task demands exceed the capacity of either hemisphere, a "time sharing arrangement" or activation of both hemispheres may be put into effect (Kinsbourne, 1975). Callosectomized patients, unlike normal subjects, for example, cannot simultaneously perform two tasks that are "lateralized" to the same hemisphere, although they can perform each task separately (Kreuter, Kinsbourne & Trevarthen, 1972). Similarly, when normal children are asked to perform simultaneously two tasks, such as tapping their finger as fast as they can while repeating a familiar verbal passage, the verbal task interferes more with performance of the right rather than the left hand (Kinsbourne & McMurray, 1975). The "overload" phenomenon is markedly reduced in adults but can be demonstrated by increasing the difficulty of the verbal task. The extent of overload by two competing tasks also differs significantly between left- and right-handed adults (Hicks, 1975).

We have examined the development of interhemispheric interactions from a somewhat different perspective by asking children to entrain on the beat of a metronome and to maintain that beat as precisely as possible by tapping with one hand or the two hands in alternation after the metronome is turned off. Right-handed girls show greater temporal precision as well as an earlier onset of manual asymmetry favoring the right hand. Sex differences as well as manual asymmetrics on this task disappear between 11-13 years (Wolff & Hurwitz, 1976). On a more complex unimanual motor task, however, adults show the same right-hand advantage and females tap with greater precision than males (Wolff, Hurwitz & Moss, in press). Thus asymmetry in motor performance and sex differences in degrees of asymmetry persist into adult life, even when the performance measures by which asymmetry was demon-

strated in childhood no longer show either sex differences or manual asymmetries. . .

In closing, I would like to consider one clinical example which may illustrate how developmental neuropsychology may help to explain the behavioral disturbances of children who come to the attention of child psychiatrists. Many children, and particularly boys, who are of normal or superior intelligence and free of organic or major neurosensory deficits have had the advantage of adequate schooling and were well motivated to learn at least in the early school years fall increasingly behind in academic work because they do not acquire the necessary reading skills. DeHirsch, Jansky and Langford (1966), Bakker (1972) and Satz and his colleagues (1971, 1973, 1974) tested Orton's maturational lag hypothesis for specific reading retardation in longitudinal follow-up designs. The nonreading measures of psychological performance administered in kindergarten were found to be efficient predictors of later reading retardation. Although the kindergarten predictors were no longer discriminating at the time when the reading deficiency became manifest 1-2 years later, more differentiated psychological measures again discriminated between groups. Such findings suggest that specific reading retardation involves more than the inability to read, that the impairment of performance in children with reading retardation reflects a maturational delay which can be compensated in ontogenesis but that the underlying maturational delay can later be demonstrated on more advanced performance measures.

Noting striking similarities in the performance profiles of children with specific reading retardation and adult patients with localized hemispheric lesions of the left hemisphere, Satz further hypothesized that maturational delay in reading retardation may be confined to left-hemisphere-dependent functions. Many children with specific reading retardation, for example, have a history of developmental language retardation, even when they speak normally at the time of school entry (Ingram, 1970); many are delayed in lateralization of function for language processing (Zurif

& Carson, 1970; Lake & Pryden, 1976); and many show a specific impairment on the temporal organization of symbolic elements (Bakker, 1972). The hypothesis that reading retardation is associated with a maturational delay of left hemisphere functions would be consistent with many clinical and experimental observations indicating that retarded readers are specifically deficient in the serial ordering of verbal and nonverbal elements ("left hemisphere" functions), whereas many of the same children are as proficient as normal readers on tasks of spatial visualization or pattern perception ("right hemisphere" functions) (Eisenson, 1966; Doehring, 1968; Bakker, 1972; Ingram, 1975). Since the academic skills which determine success in the elementary schools depend almost entirely on functions preferentially processed by the left hemisphere (Crinella, Beck & Robinson, 1971), it should not be surprising that healthy and intelligent but late-maturing children are at great risk for school failure.

The maturational lag hypothesis has not been critically tested to determine whether maturational delay is entirely susceptible to developmental "catchup." Since many intelligent adults who had severe reading handicaps as children never achieve reading fluency despite extensive remedial tutoring (Perlo & Rok, 1971), one might, in fact, conclude either that remedial tutoring is useless or that specific reading retardation is caused by irreversible lesions of the central nervous system. However, if our earlier speculations are correct that local variations in maturational rate have far reaching effects on the overall organization of behavioral development, one might expect to encounter irreversible variations in the styles of adaptation or preferred modes of processing together with reversible deficits on discrete performance measures. . .

If I have been successful in demonstrating a functional relation between variations of maturational rate and developmental profiles, the demonstration would in no way imply a direct causal relation between biology and specific clinical syndromes in child psychiatry. Reading retardation, for example, may become a clinical psychiatrically relevent syndrome when industrialized society expects its chil-

dren not only to read but also to read at a particular chronological age; or when educational policy equates intellectual competence with performance on tasks that are selectively processed by the left hemisphere. The severe emotional stresses inflicted on retarded readers are obviously not a consequence of biology but the result of society's impatience with, or indifference to, normal biological variations in rates and styles of mental development. The excessive reliance on chronological ages as the independent variable in development must therefore be held responsible for the unnecessary suffering of biologically healthy children who may be slower than their peers but who, like the tortoise, might have won the race in a more supportive environment. Since child psychiatrists neither can nor should interfere with maturational rate, their essential contribution to primary prevention in this example may be to protect children against society's biologically unsound demands that children should conform to the bell-shaped curve and to inform parents, teachers and colleagues about the inherent strength conferred on any society when it encourages individual variations.

THE ROOM WITH THE ORANGE SCREEN

for Victoria Serra

At deer level the colors open.
Where you are painting
the fresh wood parts
sap running
clear as your own veins.
Heart's

a new bird perched & singing
through your rain
wet cabin, universe
in floor & curtains: galaxies
in the folded screen.
You invite sky

through your frame
& the bonded tree of your body's
knowing
to come in as rain does
through alder leaf, fir
needle, & draw your colors

through, markers for a prayerbook
this deer step, star turn, clear
window focusing the light.

Kathy Epling

ROBERT CLARK

TO STAY ALIVE

a man
and a woman
appear
each night
wearing no clothes
carrying small satchels
full of poems
outside the wind hurts
it is january
and strong
they go to the sea
and taste the salt
they go to the market
and trade the salt
for smelts
they go to the bed
and trade the fish
for love
only
the most resourceful
have any chance
at all

Elizabeth McKim

Teaching for Cognitive Development

Intelligence can be taught

ROBERT P. BAUMAN

Major changes in understanding of the educational process have occurred in recent decades. Public and private educational systems have been in turmoil, induced by concern over international competitiveness, racial mixing, sex equality, changing social mores and other factors of direct or indirect consequence to the schools. During this period, increasing numbers of teachers have taken a new look at teaching and learning. Old truths have been rediscovered, new truths have been uncovered, and explorations have been initiated that look promising for future improvements in our ability to educate both young and old.

The IQ Game

For more than half a century, educational philosophy in the United States has been dominated by the underlying assumption of inherent intelligence. Although Binet, who originated the modern intelligence test about the turn of the century, believed that the scores would be influenced by educational experiences, it was soon accepted, especially by American psychologists and educators, that the ratio of mental age to chronological age was essentially invariant with age. Difficulties of measuring IQ were recognized, and this uncertainty provided a comfortable cushion against evidence of changing IQ scores. The major question asked, however, was what fraction of the variance in IQ was attributable to

genetics and what fraction could be assigned to environmental factors. Typical estimates were that IQ was 80% genetic and 20% environmental, with differences in these estimates between different workers at least as large as ±20% of the total variance.

Two quite different approaches in recent years have shot down the conventional model of intelligence. A variety of teaching techniques have been shown to change IQ scores in statistically significant amounts, and a careful review of the research literature on inheritability of intelligence has shown that the earlier research studies were, sequentially, inadequately designed, misinterpreted and misquoted. It seems quite safe and proper to say that, at this time, there is no significant evidence that there is a genetic component to intelligence, whereas there is overwhelming evidence that there are environmental factors influencing measured intelligence. The arguments have been documented in recent publications.

Problem-Solving Skills

In the years following World War II, Bloom became concerned about students who were failing to pass the comprehensive examinations required by the University of Chicago for admission to upperclass status. A small scale study revealed that a major cause of such failures was attributable to poor problem-solving skills. Students would read problems incorrectly or incompletely, would leap to a conclusion without proceeding through a sequence of logical steps that would lead directly to the answer, would give up without trying simple problems because they failed to see an answer immediately, and so forth.

Tutorial sessions in problem solving were conducted, where the *methods* of good problem solvers were compared with the *methods* of poor problem solvers. Practice sessions in solving problems were conducted during the summer before the students attempted the comprehensive examinations again. Performance on the examinations and in courses taken during the following year showed very substantial improvement for the students who participated in the

tutorial program, as compared with students of similar prior performance or similar aptitude who did not participate.

The methods of Bloom and Broder have recently been adapted by Whimbey, and applied by the State of Washington to adult and vocational-technical education programs there. Whimbey's method presents a clear statement of the differences in methods of good and poor problem solvers, then provides a large number of sample problems with solutions characteristic of good problem-solving technique. The prescription for classroom utilization of the material starts with a class-size discussion of techniques, followed by a separation into student pairs. One student acts as the Problem Solver, reading and thinking out loud as he attacks the problem. The other student, the Listener, has the responsibility of ensuring that the Problem Solver verbalizes all steps, watching for inaccuracies of reading or logic, and eventually helping the Problem Solver to analyze errors that have been made during the solution process. The students alternate Problem Solver and Listener roles on successive problems. The solutions written out offer guidance to the student pair as necessary.

Fun and Games

A very different approach to improving intelligence and school performance has been taken by Layman Allen and his associates. The first production was the WFF'N PROOF game, based upon the concepts of symbolic logic. This was followed by EQUATIONS, ON-WORDS, other games designed to stimulate thinking. The games are of the non-simulation type, meaning that they are not like chess or Monopoly, which simulate war or real estate speculation; instead the important rules for EQUATIONS, for example, are the rules of arithmetic. Although there are some aspects of strategy in the conduct of the game, the emphasis is always on real mathematics and what can and cannot be accomplished with the resources at hand. Because all players have the identical resources available, chance is nearly eliminated as a factor in determining the winner.

Classroom studies of WFF'N PROOF and EQUATIONS have shown that they serve to improve student interest and therefore markedly decrease absenteeism, and also produce mental development as shown by conventional measures. For example, in one summer program of 60 contact hours (four hours per day, five days a week, for three weeks), the average gain of the adolescent students on the non-verbal California Mental Maturity test was 20 points. Other studies have analyzed the nature of the gains in more detail.

Piaget

A major influence in current educational thought is the model of cognitive development described by Jean Piaget in his writings of the last half century. There are several important features of Piaget's observations. Perhaps the most important is the recognition of specific stages that each individual passes through, in the same sequential order though not necessarily at the same rate. Starting with the sensori-motor stage, from approximately birth to age two, in which the infant interacts with his environment only through direct stimuli of touch, sight, sound, etc., the progression is to a pre-operational stage, which will typically last from about age two to age six. In the pre-operational period a child can deal with real objects, even when they are out of sight, but cannot carry out mental transformations on such objects. For example, the child at this stage cannot imagine how a specific scene would appear from a different perspective, cannot describe the sequential stages of a falling, rotating pencil, and does not recognize the relationships between the direction of a liquid surface and the horizontal, in a tipped bottle, or between a chimney and the slanted roof. Counting skills are acquired, but numbers are not manipulable as abstract quantities.

During a period that may be described, for purposes of discussion, as extending from about age 6 to age 12 or 15, the child is concrete operational. At this stage, mental operations become possible, and abstract quantities can be handled in limited ways. Arith-

metic operations of addition, subtraction, multiplication, and division may be mastered. Concepts of rates are understood. For the first time, cause and effect relationships are distinguished from simple associations. Elementary concepts of area and volume are acquired, but not to the extent that the differences in units are understood.

The stage of adult-like thinking, which is expected to appear in the early teens, is called formal operational. Initial signs of reaching this stage are a grasp of ratio and proportion. Other aspects are a facility in dealing with reversibility and compensation (as in double negatives and in product functions such as a balance beam where a decrease in weight is compensated by an increase in distance), understanding of variants and invariants (as in planar figures where the perimeter may be invariant but the area dependent on shape, or the invariance associated with the additive properties of volumes), and an ability to deal with relationships between abstract quantities. It is at this stage that algebra first becomes meaningful, cause and effect are grasped sufficiently that the nature of proof may be understood, and the ability to separate variables in a multi-variable problem becomes evident.

Comparison of the Piagetian stages with traditional academic curricula shows a remarkable correspondence between the expected ability levels of the child and the demands put upon the child by the traditional program, developed by trial-and-error methods over many decades. Students who did not progress according to these expectations dropped out of school or dropped from college-preparatory course sequences into more vocationally oriented programs. Thus only those who fit the expected pattern were likely to find their way into the major colleges and universities.

Another important finding of Piaget was that mental growth, or cognitive development, is caused to a significant extent by social interactions. Disagreement in interpretation between two individuals causes one or both to reconsider and to develop new mental models for understanding the phenomenon at issue. Cognitive de-

velopment occurs at the frictional interface between conflicting ideas.

Examples of the importance of social interaction on cognitive development abound in history and sociology. Stone age men had, in general, a very inadequate concept of cause and effect, accepting explanations for astronomical and meteorological events that seem strange today. Similarly, in cultures today in which there is minimal education, there are typical patterns of acceptance of magic, absence of long-range planning (which requires looking at relationships between intangible, or abstract, quantities), and minimal mathematical skills often limited to counting and the most rudimentary arithmetic.

Cognitive Development in the School Population

Although Piaget's studies showed that adolescents typically became formal operational at age 12 to 15, more recent studies have shown that these expectations are not fulfilled for American or British school children. A few students make the transition by age 10 or 11, but only about 40% have progressed beyond concrete operational by high school graduation. Unfortunately, college courses seem to have little effect on the proportion of formal operational vs. concrete operational thinkers.

The discovery that many post-adolescents do not test as formal operational raises questions concerning the validity of the classification scheme for older students. Are the concrete-operational and formal-operational labels meaningful for 18-year-olds or for older adults? Because Piaget worked only with individuals below 16 years of age, his analyses provide no direct clue.

Arons has observed that the learning patterns of adults are quite similar to those of children when faced with new experiences. Renner and his associates have applied Piagetian tests to high school and college students and found patterns consistent with concrete operational and formal operational stages.

Current Studies

To check more explicitly the validity of Piagetian stages for young adults, a clinical-type study was undertaken in which a wide variety of test questions were given to a small group of students on a one-to-one basis. Quite often during the study it appeared that a student had answered a question that was beyond his apparent development stage, or had failed to answer correctly a question that was within his expected range as judged from other questions. In every such case, without important exception, further questioning revealed the student had been guessing, or that the student could solve the problem. That is, the results were fully consistent with the assignment, to each individual, of one or another single Piagetian stage (including rough sub-stages between concrete operational and formal operational). Although the testing program was less complete for the few much older persons interviewed at the same time (approximate ages 30, 55, and 65), the results for these people also seemed consistent with the model.

A by-product of the clinical study was an observation that the Piagetian stage correlated remarkably well with performance in a concurrent physics course for several of the students. There were serious deficiencies in the experimental design of this part of the study, however, for the course grades were assigned by the investigator. Therefore a separate analysis was conducted for approximately 30 students who were not known to the investigator. On the basis of paper and pencil tests of Piagetian level, administered by third parties, predictions were made of expected grades for the students in a physics course. Class records were then checked to see which of the students had subsequently taken a physics course and predictions were compared with actual grades earned. The correlation was remarkably high, suggesting strongly that the developmental stage of the student on entering the physics course was the primary factor determining the grade earned.

Stimulation of Cognitive Development

The separate pieces of the puzzle of cognitive development and intelligence now seem to fit together, with important implications for teaching. There is reason to believe that success in school is determined, to a significant extent, not only by "intelligence," as measured by standard tests, but by the cognitive development stage as measured against Piaget's model. Furthermore, there is good evidence that intelligence in general, and cognitive development in particular, is primarily (if not entirely) a consequence of environmental influences. Also, preliminary studies seem to show that individuals lie along the same linear development track, as suggested by Piaget's studies of children and adolescents.

The implication seems clear. If our students (young and old) are not as far along the track as we would like, but are still on the track (and there is no evidence of individuals having jumped the track), and if progress along the track is determined primarily by environmental factors as accumulating evidence would indicate, then it becomes a responsibility of teachers to provide appropriate environmental influences to move students further along the track of cognitive development. We can no longer justify a process of screening students according to the levels they have achieved and discarding those below some cut-off level.

The key question then becomes how much a teacher can do to change the cognitive level of students. Is it possible to make bright students out of dull students? The question usually generates heat, but there are few specific answers available in the literature. It was in large part to obtain an answer to this question, of whether teaching can be effective, that some experimental courses have been designed and initiated at the University of Alabama in Birmingham.

Three courses, or course-sequences, have now been initiated. The first, designated PHYSICS 10, Mathematical Preparation for Physics, is a one-quarter course, carrying three semester hours of credit. It is fully self-paced, allowing students to complete the work in less than a quarter (although few have done so) or over

a period of two or more quarters. The course has been required for those students who wish to enroll in a physics course but cannot pass a screening examination that tests primarily for elementary mathematical skills. It is also elected by some students to satisfy general degree requirements in science, or as preparation for courses in other areas.

The second course was a summer cognitive therapy program for incoming college students of marginal ability, as measured by high school grades and ACT scores. During the summer quarter, of ten weeks, the students met four hours per day, five days per week. Six hours were devoted to English, in small class sections, with emphasis on encoding and decoding of ideas (getting an idea into English or abstracting thoughts from English). Approximately four hours per week were devoted to problem-solving skills and early units of the PH 10 course. Two hours per day were devoted to playing games, including EQUATIONS, WFF'N PROOF, and ON-WORDS. The program was supported by a Teaching Improvement Program grant, from within the University.

The third course sequence, arising from the other two, is a three-quarter sequence, primarily for freshmen, based largely on problem-solving skills, PH 10 material and the games. This sequence, designated PHYSICAL SCIENCE 7, 8, and 9, is combined with a strong counseling program and, for most students, enrollment in the standard freshman English course that provides remedial help for those who require it. The program is supported, in part, by a Special Services grant from the Office of Education, DHEW.

The Foundation Course, PH 10

Piaget has observed that the several stages of cognitive development must be achieved sequentially. It seemed appropriate, therefore, to design a cognitive development course such that it would start with the most basic levels expected for the student popula-

tion, working upward toward the level required for success in physics courses, and then allow students to progress through the material at their own pace. The first unit deals with counting, followed by units on addition, subtraction, multiplication and division. Emphasis is not on drill, but rather on understanding the structure of the relationships. Unit 6 offers practice in multiplication by requiring the students to count the number of possible arrangements of objects under specified rules. For example, given 4 objects, in how many different orders can they be arranged (N factorial, or 24), or, by taking some, none, or all, how many different combinations could be achieved (2^N, or 16). The emphasis is on counting available choices at each stage, then combining those numbers. Test questions require development of variants to account for indistinguishable objects.

Subsequent units cover punctuations and graphing, implication (see below), units and dimensions, powers and roots, number bases, equations (including solution of quadratic equations), multiplication and factorization of polynomials, and conjunctions and disjunctions in elementary symbolic logic.

The last third of the course leans more toward specific areas related to needs in physics courses, including significant figures, series and approximations, kinematics (time-rate-distance and acceleration problems), a review of plane geometry, trigonometry, complex numbers, matrices and determinants, and vectors.

Initially the last unit of the course was the EQUATIONS game; the students played several games with each other, and all seemed to be favorably impressed. In an effort to decrease the volume of material, and make room for problem-solving skills, the game has been dropped and two of the later units made optional.

We now have the students go through about one third of Whimbey's workbook on problem-solving skills early in the course, working in pairs. The reception for this material has been very good. It seems particularly effective in making students aware of their own thinking processes for the first time (a characteristic of the formal operational stage), thereby immediately affecting thought patterns in other courses.

One of the early surprises came with Unit 8, on implication. Bereiter and Engelmann had observed that disadvantaged preschool children could quickly learn to deal with simple implication statements, such as, "If it's red, it's round." It appeared reasonable, therefore, to ask college students to deal with such statements. It was discovered, however, that when all eight variations of a simple implication statement were written out, including negatives, none of the students could readily distinguish those that did or did not follow as true or false from the original statement and those that were undetermined. The ability to understand such problems and to convert statements in English from other formats into standard implication form ("If . . . then. . .") is further tested by Unit 14, where conjunction ("and") and disjunction ("or," in the meaning "and/or") are introduced. At the end of this unit the meaning of "if and only if" becomes clear to most students for the first time.

Probably the most important characteristic of the PH 10 course is not the specific material in the workbook, but rather the way in which the course operates. In the workbook and on the unit tests, the intent is to ask hard questions about easy material. Emphasis is on making students explain how they know answers. For example, the unit on counting begins with a definition of the number of objects as the largest number reached in counting, taking each object once, which is followed by an axiom that the number is invariant to the order of counting. Students are then given the "game" of showing a child he has 11 fingers (count on one hand: 10, 9, 8, 7, 6, and add the five fingers of the other hand: $6 + 5 = 11$). The student is then asked to explain two aspects: first, why he knows that the error is not simply in the order of counting (which requires only a restatement of the axiom already given), and second, how it can be shown that the method is not as close to "correct" as it seems (for example, by breaking the count at another point, thus getting an odd number greater or smaller than 11).

The Workbook has many places for answers to be filled in, and these are checked, often with verbal questions asked by the instructor about the material. When the unit has been completed,

the student receives a unit test (generally one of three or more versions) as an open-book test. The unit tests are of sufficient difficulty that they are most often not answered fully correctly the first time. Errors are indicated, and the tests are returned to the students for correction. No record is kept of student mistakes; only satisfactorily completed tests are recorded. The student works on only one version of the unit test, but must get it right.

There is a great deal of student cooperation in the class, but a surprisingly small amount of simply telling answers. It is a common occurrence to have several students stand quietly by, with subdued smiles, listening to another student struggle with a problem others have all previously solved.

Student response to the course varies, but there is also a great deal of uniformity of attitude. A typical comment would be, "I'll sure be glad when I get through this course. It's an awful lot of work. But I enjoy it, and I've learned more from this course than from any other I've taken." For the instructor, it is rewarding to see students in the later stages solving problems that they could not have grasped a few weeks earlier.

A final examination is given as a closed-book test. It may be retaken (in an alternate version) as many times as desired, but in recent quarters no student has taken the exam more than twice. Most students manage to achieve an A or B on the first or second attempt, which is sufficient for an A in the course if all units are completed. Colleagues, who are often most difficult to convince concerning academic level of a remedial program, have uniformly agreed that the final examination is tough.

Summer Cognitive Therapy Course

Probably the most striking feature of the summer course, in retrospect, is that we discovered, during the summer, that the really slow students we had taken into the program were an exceptionally bright group of exciting youngsters. Examples of initial difficulties are that none of the students recognized on the first day that $1 \div 2$ was the same as $\frac{1}{2}$. (Some thought it was 1, some

said 2, and one carried out the division process and answered 5.) Several students could not solve an equation, such as $3x = 5$, for x. Mathematics ACT scores seem to have been randomly scattered about the value expected by pure guessing.

After a period of concentrating on the Whimbey problem-solving materials, the students worked through the first eight units of the PH 10 workbook. Not all completed that much (one student completed no units), but most were at the point of beginning to master the implication statements. Graphing was a particularly difficult unit, leading us to prepare introductory material for that section for subsequent classes.

The games were operated as tournaments, students competing against others of matched ability at each table but operating as teams, each team matched as closely as possible with the others to include all levels of ability. At the end of each set of games, the winning student moved up one table, the loser moved down one. EQUATIONS provided practice in elementary arithmetic and later introduced powers and roots. WFF'N PROOF further emphasized the mental manipulation of relationships, and the need for looking at alternative solutions and the need of each to check his own work because others are waiting to challenge any mistakes. ON-WORDS was played on Wednesdays for variation but also to sensitize the students to vocabulary, and incidentally to spelling skills.

The primary early measure of success was the ACT examination, given at the end of the summer and compared with pre-entrance scores. Original plans were to have 30 students, but some students did not appear and were not replaced. Approximately 24 students did participate, of whom 20 stayed through the quarter. Several of these were absent as much as half of the time, and were therefore excluded from the analysis. Thus 14 students could be compared for ACT pre- and post-tests. The scoring process included an adjustment for the maturation normally expected between test dates. Increases in means were as follows: English, 1.4; mathematics, 1.7; social science, 0.2; natural science, 3.9; and composite, 1.9.

Gains in English were almost significant at the 5% level ($t = 1.99$ vs. 2.16) for a two-tailed distribution. Gains in natural science ($t = 3.27$) and in the composite score ($t = 2.82$) were clearly significant. Considering the small number of students for statistical analysis and the limited time of nine weeks to work with them, these results were encouraging. The changes in student attitudes and self-confidence were not measured but were striking.

Academic Year Program, PHS 7-8-9

Most students have agreed that the PH 10 course, although very helpful, comes too late for maximum efficiency. Most of the students have taken algebra and pre-calculus courses, and perhaps a third have had one or more calculus courses. The summer program was effective but was too short and was expensive in its experimental form. What is clearly needed is a program that will meet the needs of incoming freshmen, of all academic major areas, within the context of traditional course, tuition and staffing patterns. The PHS 7-8-9 sequence is a close approximation to that goal, although it must still be considered experimental in some minor respects.

Students enroll in PHS 7 as a three-semester-hour course, but are assigned also to a laboratory period following the class period, which is devoted to the games (e.g., EQUATIONS) and other special activities. With an opportunity to deal with the same students, in PHS 7, 8, and 9, over 9 or 10 months, instead of 9 or 10 weeks, there is an opportunity for much greater effect.

Students will go through the Whimbey problem-solving material, most of the PH 10 workbook units, and in addition do a few simple laboratory exercises involving measurements (in the classroom) and learn some supplementary study skills. One full time instructor is assigned to the 100 students, in three sections of approximately equal size, with one graduate student assistant (approximately 20 hours per week). Another weekly period is set aside when all the students may be brought together for counseling or for testing for documentation purposes on the program. A senior faculty member is available as a consultant.

Summary and Conclusions

There is ample evidence that our educational system has been more effective in awarding diplomas than in maintaining the standards of education expected of our schools. Such evidence includes the drop in standardized test scores at the national level, less publicized drops in performance on examinations used over a decade or more by individual institutions, and the observation that a majority of students entering college are not fully formal operational, although most college textbooks are written for students who are at this upper level of development.

Evidence has also accumulated that the ability to handle academic material is not inherited, but must be learned. Almost as a rearguard action to protect teachers from responsibility for poor student performance, it has been suggested that there is a critical age, beyond which little or nothing can be done to help retarded children. However, the advocates of such an assumption have been unable to agree on whether the magic age is 1 or 3 or 7 or 14, and reports in the recent literature do little to support the hypothesis for any age. The alternative conclusion seems to be that teachers do have a responsibility for the intelligence of students leaving their classes. The studies reported here, though limited in scope, lend direct support to the interpretation of intelligence as something that can be learned in a classroom setting.

Remedies for current difficulties are not likely to come easily. Many of the techniques that we have tried and found successful are capable of being applied in elementary and secondary schools. For example, Professor Allen has initiated a highly successful adaptation of the EQUATIONS game in school systems of Detroit and Ann Arbor, and Whimbey's material is almost independent of the instructor. Nevertheless, leading students to develop formal operational thought apparently requires an instructor at that level, and many of the elementary and secondary teachers graduated in recent years by our colleges and universities are concrete operational or in early stages of transition toward formal operational.

What can be done now is to further explore the ways of raising student intellectual levels and take steps to ensure that all future graduates, not just those in selected disciplines, have been exposed to courses in which serious thinking is required. If proper steps are taken to raise the cognitive development level of students entering college, it will be possible to re-establish the intellectual levels of college courses without excluding a majority of our students from those levels.

Appendix

Perhaps some feeling for the content of PH 10, and thus indirectly of the way in which students are led to develop new thought patterns, can be obtained from a few sample questions of the type contained on the unit exams. The unit in which these questions appear is indicated by the Roman numeral preceding the question.

IV.

If zero stands for "nothing," how could you justify putting units on zero?

Mortimer wrote a check, then discovered that his bank balance was overdrawn, showing a balance of −$5.00. He didn't worry, however, because he had learned in school that two negatives makes a positive, so he simply wrote a check for $5.00 and cashed it to give another overdraft of $5.00. Explain, for Mortimer, how his logic went astray.

V.

If y is proportional to x, doubling x will always double y. What will be the characteristics of the graph of y vs. x?

If a 10″ pizza costs $1.00 how much should a 12″ pizza cost?

VI.

If you are given one bag of blue marbles, one bag of green marbles, one bag of yellow marbles, and one bag of red marbles, how many (distinguishable) ways could you put one marble into each of 5 boxes? _____ Explain.

How many two-letter words are possible in English? _____ Explain (Possible words include aa, ab, ba, etc.)

If you are given one blue ball, one green ball, one yellow ball, and two red balls, how many (distinguishable) ways could you put one ball in each of 5 boxes? _____ Explain.

VII.

A cube is 3 ft. on a side. How would you cut a cubic piece from it that would give you 1/64 of the total?

VIII.

Given the valid statement, If it changes its speed, it is accelerated; which of the following are necessarily true, which are necessarily false, and which are undetermined.

If it changes its speed, it is not accelerated.
If it does not change its speed, it is accelerated.
If it does not change its speed, it is not accelerated.
If it is accelerated, it changes its speed.
If it is accelerated, it does not change its speed.
If it is not accelerated, it changes its speed.
If it is not accelerated, it does not change its speed.

Express the following statements in "If . . . then . . ." form. Assuming the original statement to be valid, give a variation that will necessarily be true and two variations that will necessarily be false.
Patriotic Americans like apple pie.
It is always warm in summer.
An object slows down only when acted on by a force.
The best team will win Saturday.
Only reptiles are snakes.

X.

Given that $(n^p)^q = n^m$, what is m?_____ Check your conclusion by substituting numbers.

$27^{2/3} =$

$9^{5/2} =$

Is $n^{(p^q)} = (n^p)^q$?

XI.

Express the base 8 number (26/6) as a binary number.
Express the base 8 number sum (6 + 23) as a base 12 number.

XIII.

a. Find the first 5 terms of $(1 + a)/(1 - a)$
b. Evaluate 101/99 to three significant figures (without dividing!). Show your work.

XVI.

Estimate: $\sqrt{65}$
$\sqrt{10}$

Given $\ln 3 = 1.099$, find $\ln 9$
$\ln 10$

Estimate: $e^{.02}$
$e^{-.03}$

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ARTICLES

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Starlene Bethel, a senior at Phillips Academy, lives in Columbus, Ohio.

Also a senior at Andover, Robert Clark hails from Garden City, New York.

In his eleventh-grade year at Andover, Charles Dean makes his home in Norwich, Vermont.

Anthony DeLuz lives in Dorchester, Massachusetts, whence he attends the Boston Latin School.

Anna Glumicich, an eleventh-grader at Andover, lives in Wilton, New Hampshire.

James Lombard attends Phillips Academy from Chappaqua, New York.

An eleventh-grader at Andover, Kristin Timken comes from Canton, Ohio.

POEMS

Diana der Hovanessian works as a poet in the Massachusetts schools (Newton, Quincy, Cambridge) giving student and teacher workshops. Her poetry has appeared in *American Scholar, American Poetry Review, The Nation,* and *The Paris Review.* An anthology of Armenian poetry translated by her will come out in 1978 (Columbia Univ. Press).

Kathy Epling lives in northern California with a basset, a pregnant cat and a three-month-old son, Garth. She works at the Orange Cat Goes to Market bookstore.

Richard Grossman's work in this issue is part of a 500 poem pastoral, *The Animals.* Other poems from the collection have appeared in *The Southern, Paris* and *North American Reviews, Poetry Northwest* and the *Carolina Quarterly.* His book on his career as a businessman, *Tycoon Boy,* was published earlier this year by *kayak.*

Phyllis Janowitz recently won the Associated Writing Program Poetry Competition for her collection *The Rites of Strangers,* which will be published by the University Press of Virginia.

Susan (Bartels) Ludvigson has published poems in *The Nation, The Paris Review, Southern Poetry Review* and *The Georgia Review.* She has published one book, *Step Carefully in Night Grass* (John F. Blair, Publisher, Winston-Salem, 1974), and teaches in the English Dept. at Winthrop College in Rock Hill, S.C.

Elizabeth McKim works with people of all ages running poetry workshops throughout Massachusetts. She also teaches a poetry workshop at the Arts Institute of Lesley College. Her poems have appeared in many magazines, and her first book, *Burning Through,* will be published by Wampeter Press in May.

Mary Oliver lives in Provincetown, Ma. She has published three collections: *No Voyage and Other Poems; The River Styx, Ohio;* and *The Night Traveler.* In 1972 she received the Shelley Memorial Award, and she has also been awarded a National Endowment Writing Fellowship. Recent work has appeared in *Ironwood, The Ohio Review, Atlantic Monthly* and *Commonweal.*

ANNA GLUMICICH